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ABSTRACT

This book uses an analogy of "The Wizard of Oz" to offer information about cognitive research, sharing simple tactics for implementing these ideas in the classroom. The book discusses expert findings about brain growth, structure, and functions to help teachers and administrators foster a love of learning in all students. Key features include: discussion about memory pathways, learning styles, and multiple intelligences; extensive examples from real school situations where brain research has been applied; tactics for immediately putting brain-based information to work in the classroom; and concrete techniques for using music, teams, rapport building, and brain-state changes to stimulate student learning. The eight chapters are: (1) "The Journey: The Brain Goes to School"; (2) "Following the Yellow Brick Road: Understanding Brain Structure and Function"; (3) "If I Only Had the Nerve: Dealing with Stress"; (4) "If I Only Had a Heart: Emotional Growth"; (5) "If I Only Had a Brain: Complex Cognitive Skills"; (6) "Which Witch Is Which?" Calming and Controlling the Classroom"; (7) "Dorothy: Teaching Different Brains"; and (8) "No Place Like Home: The Learning Environment." A glossary of terms is included. (Contains 112 references.) (SM)

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How to Make
Every Year
Your Best Year

Marilee B. Sprenger

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To the reviewers of this book, I appreciate your professional advice. You made me think about ideas, discoveries, and concepts that added to the content of this work.

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Principal
MMC Community Schools
Marcus, IA

Josephine Galliher
Assistant Professor
School of Education
Adelphi University
New York, NY

About the Author

Marilee Sprenger is one of the few brain-research translators who has spent years applying research in the real world of the classroom. She is an educational consultant and an adjunct professor at Aurora University, where she has designed several graduate courses on brain-based teaching and brain research. Currently, she speaks at national and state conferences, as well as providing staff development to schools all over the continent. She is an international presenter and author of several books, including *Learning and Memory: The Brain in Action*. As a member of the American Academy of Neurology, she remains current on the latest brain research. She can be reached at: msprenge@aol.com.

To Scott, Josh, and Marnie
for their love and support—
and to the wizard who
started me on my journey,
Eric Jensen

Introduction

"The road to the City of Emeralds is paved with yellow brick,"
said the Good Witch, "so you cannot miss it."

I have been helping teachers set up brain-compatible classrooms since 1992. When I began creating an environment in which the brain could function at its best, my entire teaching career changed. I enjoyed my work more, and my students were happy and learning. I followed the curriculum and covered the content in a way that provided for both the emotional and social learning of my students.

At certain points in my career, I found myself more wrapped up in testing, grading, competition, and covering curriculum. When that occurred, my classroom was less fun, more tedious, and lacking in the drive and motivation that it usually had. It reminded me of the days before I knew that students had brains, that brains had everything to do with learning, and that *I* was responsible for helping them grow.

The analogy of *The Wonderful Wizard of Oz* came to me one sleepless night. I was trying to make sense out of stress management, emotional learning, and cognitive skills. When I feel fearful and want to get myself "de-stressed," I often say, "It's time to tame those lions and tigers and bears!" I started comparing Paul Maclean's triune brain model (Hooper & Teresi, 1986) to the lovable characters from the book. The reptilian brain was certainly the Cowardly Lion. They both were constantly dealing with survival. The mammalian brain, which Maclean called the seat of emotion, was represented by the Tin Woodsman.

This limbic area sought emotional balance so that learning could take place, and the Woodsman wanted a heart so he could feel. The Scarecrow, who has always been my favorite, wanted a brain, to do higher-order thinking. He was the perfect representative of the cortex. After this all hit me, the other characters fit into place—particularly the Wicked Witch. For as long as I have been teaching, I have referred to myself as the Wicked Witch of the West whenever I'm in a bad mood. I have simply warned my students as well as my own children that, at that moment, I was the Wicked Witch. The warning has been well heeded.

I have learned much in my years of studying brain research, not only about the parts of the brain but also something more important. I have learned that some of the strategies I was using that worked weren't necessarily good for kids. I was trying to tame those lions and tigers and bears with threats and wielded my power of homework or grades to prove who was in control. I was trying to force learning when all I had to do was create the atmosphere to allow it to happen. And there were times when I was teaching and no one was listening because emotionally it just wasn't possible for them to do so.

It is not always easy to feel confident that what I am doing is successful. There are days when the Wicked Witch is always fighting those lions and tigers. The knowledge that I do sometimes succeed comes in small packages: students returning to my room just to sit and feel "safe," letters and calls about how much they remember from my classes and how it has helped them in high school, and standardized tests scores that go up.

I am still making my own journey. There have been many bumps in the road, and I have to remind myself about how to tame my own personal lions. While writing this book, I faced my biggest challenge. I was diagnosed with breast cancer. It was devastating, and I had to cope with another journey. I was a member of a club that I hadn't wanted to join. Did I have the skills I needed to handle this situation? Amazingly, many of the concepts presented here were helpful to me. For instance, I knew that I needed support, and I sought it. I needed outlets, and I found them. My understanding of the brain and stress allowed me to make decisions about my attitude, my medications, and my health. I discovered that what I was doing in my classroom could have lifelong and life-altering affects. I hadn't wanted to give these strategies this particular test, but I was relieved to discover that they passed. Having this information has affected my classroom, my personal life, and I hope, the lives of many students who were in my care. This book is for anyone who feels that his or her personal journey is ongoing and wants to use current research to broaden and enhance the trip down the Yellow Brick Road.

1

The Journey: The Brain Goes to School

It is a long journey, through a country that is sometimes pleasant and sometimes dark and terrible.

—The Good Witch of the North

It is my first day at a new school. I am both nervous and excited. Even though I consider myself a veteran teacher, I am somewhat apprehensive as I look around my new room. I have several minutes before my students arrive, so I dash into the teachers' lounge to meet my colleagues.

When I enter the small, cluttered room, three teachers are seated and chatting. They look up and smile. "You must be Marilee. You're taking Paula's class," one of them says. "That's right," I reply. "I'm really looking forward to this."

"Don't take them on any field trips!" all three teachers say simultaneously. "They haven't been out of the building since kindergarten."

I am mildly shocked as I rethink this new position. These children are now in sixth grade. If I keep this job, I will have them for seventh and eighth grade, too. What have I gotten myself into? I quickly decide to disregard what the teachers have told me. After all, I've been around

long enough to know how to handle students. The class can't be *that* bad!

The bell rings, and the students enter the building and go to their respective rooms. I stand at the door to greet them. I am suddenly overwhelmed by the fact that there are so many of them—and so many boys! When they all get settled, I start to take attendance. I call out their names to try to connect names and faces. As I finish, I realize that I have 32 students and 20 of them are boys. Four rows of eight desks look endless in the narrow room.

Oh, well, no problem. It is time to get started. I quickly introduce myself and give them a little background. As I am sharing, one of the Davids (there are two) gets up out of his seat and goes to the pencil sharpener. I immediately stop in midsentence. "Excuse me, (now I can't remember his name) I am talking, so you will have to sharpen your pencil later." He smiles and returns to his seat. I continue.

Seconds later, David #2 goes to the trashcan with some paper that he crumples on his way. The noise and the movement are very distracting. "I'm sorry, but no one should be out of his seat," I state in no uncertain terms. No sooner do I have that out, and two boys start scuffling in the back of the room. "Hey, hold on there!" I shout, to no avail. David #1 runs back to the boys and joins in. A cheerleading squad of both boys and girls suddenly develops, and they chant, "Scott, Scott, Scott . . ."

As I hurry to break things up, I say to myself, *"Well, Dorothy, you're not in Kansas anymore!"*

For weeks, I am near tears as I leave the building each day. I try desperately to get those 32 kids to behave the way I want them to, but nothing works. Finally, I realize that if *they* aren't going to change, then I must.

My research begins: right-brain, left-brain classes; discipline classes; parenting classes; reading about music to soothe the soul; and reading Howard Gardner's *Frames of Mind*. I finally have enough ammunition to begin to deal with my situation. I work hard and see some improvements.

In the Summer of 1992, my life changes. I take a course from Eric Jensen on brain-compatible teaching strategies. During the week, Eric and I talk about my research and what I have learned from him. He asks me if I'd like to get trained and learn how to present the workshop. I promptly say "No." I was born and raised in Peoria, went to college in Peoria, and married my high school sweetheart. It scares me to death to think about a dramatic career change.

The class ends on Friday, and I go home thinking about my decision not to go. I begin to pout. My husband, Scott, says the words that made the difference: "If you don't go, nothing will ever change." That both scares and motivates me. I call Eric and begin my training. I have no intention of teaching the classes to other teachers. I just want to learn as much about brain-based learning as I possibly can.

Some strange things happen that following year. I put all the strategies to the test. They all work. Students are happy. I am happy. Parents are happy. Test scores go up. I finish the textbook for the first time ever.

This is too good to keep secret. It is time to share this information. I begin teaching classes for educators during the summers and on weekends. The classes are well attended. As I continue my research, I realize that my challenge is to keep up with the latest discoveries. My classroom becomes a laboratory of sorts. I research carefully to be certain that nothing I try could be in any way harmful. I find myself loving my work as well as my students. They appear to be happy and eager to learn.

The questions I have struggled to answer through the years are "What does every child need from me and from school?" "What can I do to relieve stress in the classroom?" "How can I help students get along with each other?" "How can I help students learn more easily?"

Life is a journey, and school is a major part of the journey for children. To understand how some of our children manage to withstand the journey, how some of them master the journey, and how others succumb to the stress and fail, I first need to gain an understanding of how the experience affects the brain, and how the brain affects the experience.

When I first begin studying the differences among students' responses to and at school, I am curious as to why some fare better than others. I am also amazed at the children considered at risk who thrive and become successful. What do these kids have, and where did they get it?

Researching the Research

To answer my questions, I wanted to find out what the experts said about these thriving kids. What did they think was necessary for children to do well in school, overcome obstacles, and bounce back from disappointment and adversity?

Nature or Nurture?

The question of genetics versus environment must first be examined. We are born with sets of genes that act as blueprints for some of our development. They are responsible for the colors of our eyes, the shapes of our noses, and the migratory patterns of our brain cells (Hyman, 1999).

Are they also responsible for our behavior? Research has been ongoing, with many interesting results. In the search to understand intelligence, many studies show that from 50% to 60% is related to genetics. That leaves approximately 50% for environment and experience. Researchers such as Dr. Sandra Scarr believe that given the proper opportunities, the environment allows genes to point individuals in specific directions (Perkins, 1995).

As Dean Hamer and Peter Copeland (1998) explain in their book, *Living With Our Genes*, molecular biology discoveries suggest that genes are the most powerful factor in our behavior, yet some traits can be changed, controlled, or modified. We can be shaped by our environments and by individual experiences. Biology doesn't have to be destiny. Genes don't necessarily predict any absolute fates; they can be amplified or stifled by situations (Hayden, 2000).

> Biology has made discoveries that suggest genes are the most powerful factor in our behavior, yet there are traits that can be changed, controlled, or modified. We can be shaped by our environments and by individual experiences.

The Neurobiology of Coping

Dr. Robert Sapolsky (1998), of Stanford University, has been studying stress and its effects on the brain for many years. He has followed the brain and body reactions to chronic stress and made some amazing discoveries. People who exercise show lower levels of stress hormones in their bodies when they encounter potentially stressful situations. Exercise appears to be a factor in coping. When people know they have options, they also feel less stress. This goes along with feeling a sense of control in your life. The knowledge that you can handle a situation or change it alters your reaction. One morning, a student said to me (about another teacher) "Uh-oh, Mrs. Phillips is wearing a skirt today. She must be in a bad mood." I chuckled at this comment,

but the student had learned that this particular teacher dressed to fit her emotional state. The student knew she would have to be very careful not to upset her teacher that day. This measure of predictability enabled the student to cope.

Social interaction is critical to a healthy approach to tough situations. Having someone to talk to or share the circumstances allows for easier management. In some studies, two groups of mice were given mild electrical shocks. Within the experimental group, a mouse was given a warning that the shock was coming, a piece of wood on which to chew, or a fellow mouse to share the experience. The mice in this group were found to have lower levels of stress hormones in their systems than those in the control group with none of these variables (Sapolsky, 1999).

We can look further into the effects of stress on particular areas of the brain. The hippocampus, which is needed for the storage of long-term memories, is negatively affected by stress. Chronic stress can cause the hippocampus to lose cells and shrink. This could cause a student to have difficulties storing new memories and therefore have difficulty in school.

A lower incidence of illness has been found in people who have more and varied social interactions throughout the day. Although we might believe that being in contact with more people exposes us to more germs and illnesses, studies reveal the opposite. Simple gestures of support from others can also lower hormonal responses in stressful situations. Stress hormones are known to interfere with infection-fighting immune cells (Sternberg, 2000). Students who have positive social interactions may remain healthier and show better school attendance, which would positively affect their academic performance.

Research Experts

Emmy Werner has studied large groups of people over the course of many years. Her work in Hawaii has added much vital information to the knowledge of coping skills. Her findings from studying a group of high-risk children as she followed them through to adulthood shed some light on this topic. Of these at-risk children, those who grew to be successful adults had several protective factors going for them. The study found that factors necessary to overcome obstacles include an internal locus of control, interaction with the environment in a physical manner, assigned responsibility, age-appropriate reading skills, and a variety of support. The support should come both from within the family and from outside the family. Children who experience these conditions often prove to be *resilient*. The studies also suggest that even if

parents are remote and inaccessible, a child can still thrive with the care and concern of other adults. Children need to develop trust, autonomy, and initiative (Werner, 1992). If children possess these protective traits, they seem to handle unpredictable situations and scenarios that put them at risk.

Age-appropriate reading skills are critical to the educational process. Educators and scientists are working on this problem. Dr. Paula Tallal, of Rutgers University, works with children who are language-learning impaired. Her work, along with that of Dr. Michael Merzenich, includes developing a computer software program that slows down the phonemes and enables the students to discriminate between sounds. Difficulty in hearing those sounds interferes with a child's reading ability (Tallal, 1999). Pat Lindamood and Nancy Bell have developed a program that makes students aware of how sounds feel when they say them. They also help students visualize what they have read, to help them remember (Kantrowitz & Underwood, 1999). The work of these researchers and practitioners may help us fill the need for age-appropriate reading skills.

William Glasser has written several books on the subject of what individuals need to thrive in this world. He found that the five essential needs include survival, power, fun, freedom, and a feeling of belonging. With these elements, children can function at their peak. Throughout their lives, they are striving to fulfill these basic needs, and their behavior is dependent on whether or not they do so. If one or more of the needs are lacking, the behavior we see in the classroom is whatever the child thinks will accomplish the task of meeting them. In a school setting, both teacher and child must have these needs met for a satisfying learning experience (Glasser, 1992). Ideally, these fundamental ingredients must be present in all areas of life.

I have always been fond of what Dr. H. Stephen Glenn (1990) has to say about children, self-esteem, and self-reliance. He has outlined what he considers to be the greatest human needs. Children, as well as adults, must feel they are a necessary part of something. Personal potency is a need to feel as though one matters in the world. Children want to influence their own destinies and will relate this through their behavior in some way. They want some control. Relationships that enable feelings to be shared and ideas to be respected are compelling factors. Children want to be listened to and understood. If they do not have these needs met by adults, they will go to their peers. This is not always an ideal situation. When problems arise, an experienced person is usually more helpful. Finally, children must feel that their lives have significance and that what they do matters.

A study of "hardy" adults produced interesting results. The adults lost their jobs and were followed to observe how they managed this traumatic situation. Those who did well actually found the circumstances challenging. They

faced matters head-on. These people also showed commitment in their lives. They were dedicated to their families, friends, and employers. They had strong relationships with others and, similar to the previous findings, an internal locus of control. Because of these protective factors, they knew the situation was within their control and that they could solve the problem (Kobasa, 1979; Sylwester, 1995).

The McCormick Tribune Foundation (1997) released a video for parents. This 1-hour presentation elaborates on the 10 things every child needs. Although they targeted younger children, I found their list compelling. They begin with the concept of interaction. Children need to interact with others and with their environment. Children also need to be touched. This is imperative in building parts of the brain and for strong emotional intelligence. Stable relationships are on this list. Children need to have others in their lives on whom they can count. A safe environment, self-esteem, and quality child care continue the list. I believe the next component, play, is one that every person needs. Play is necessary to practice social skills that will be needed in everyday living. Both pretend play and role play can allow children to learn empathy and create mental models of what course of action to take in social situations. Communication, music, and reading complete the list. I discuss many of these aspects in more detail in later chapters.

My study could not be complete without the *resilient factors* that Martin Seligman, of the University of Pennsylvania, feels are necessary. He is an expert in the field of optimism, a trait that has been found to be essential for health and longevity (Mahoney & Restak, 1998; Seligman, 1990). Optimists are healthier and have stronger immune systems. If child optimists are healthier, they spend more time in school and, as a result of their attendance, may learn more and have better social interactions with others. Choice is another ingredient that has been found to help children thrive. The list concludes with control and social support (Seligman, 1990). Seligman has also studied learned helplessness. I will cover this condition as it relates to the classroom in a later chapter.

Survival Experts

A final thought crossed my mind as I was reading the studies and reports on coping skills. At the Holocaust Museum, in Washington, D.C., I found a book that listed seven human needs. The millions who survived the Holocaust would know better than the rest of us what is needed to survive. These needs begin with security. One must feel safe in one's environment. For some of our students, our classrooms are their safest surroundings. Acceptance is the

second need. Every individual wants to be unique and to be respected for that uniqueness. Research has shown that acceptance of oneself is the first step toward filling this need. Belonging is necessary because each of us desires to be a member of a society that appreciates us. Fitting in is more important than learning to many of our students. To have the ability to make choices about one's own life, a person must have self-determination. Knowing that he or she can establish goals and carry them out can make a great deal of difference. Structure is a component that gives some predictability. We all would like to have some knowledge of what to expect and what is to be expected of us. These last two needs go hand in hand. We need a purpose in our lives. We need to feel that we contribute to a society in a meaningful way, and we want validation for that contribution (Quenk, 1997).

Emotional-Intelligence Experts

Taking the results of these studies and the suggestions of the experts, I turned to Daniel Goleman's (1995, 1998a, 1998b) work with emotional intelligence. He has found that children do not learn well without the emotional and social skills he describes. To deal with others, one must be aware of one's emotions, recognize and understand the emotions of others, be self-motivated, control impulsivity, and be able to handle relationships. In Howard Gardner's (1985) theory of multiple intelligences, these are the interpersonal and intrapersonal intelligences. These skills may be more important than the cognitive skills we teach.

The ability to cope and be resilient in life is very much influenced by our ability to get along with others. Our society is set up for interaction. In earlier societies, interaction related to physical survival. Today, it is intertwined with emotional survival. Learning is a social event; for any of us to become lifelong learners, we must engage in the process with others.

The Outcome

Several central ideas are repeated in these expert findings (see Table 1.1). I have taken these strong points, applied them to the current brain research, and outlined brain-compatible teaching strategies to help meet students' needs in the classroom. Throughout my personal journey, I have applied

TABLE 1.1 Research on Coping and Resiliency

Coping Skills *Sapolsky* 1. Physical outlet* 2. Choice* 3. Control* 4. Predictability 5. Social interaction*	Resilient Children *Werner* 1. Internal locus of control* 2. Interacting physically with environment* 3. Assigned responsibility 4. Age-appropriate reading skills 5. Variety of support*	Hardy Adults *Kobasa* 1. Challenge 2. Commitment 3. Internal locus of control*
Basic Needs *Glasser* 1. Power 2. Fun* 3. Freedom* 4. Belonging* 5. Love	Resilient Factors *Seligman* 1. Optimism 2. Choice* 3. Control* 4. Social support*	Greatest Human Needs *Glenn* 1. Personal potency 2. Control* 3. Relationships: Feelings and ideas are respected* 4. Life has significance
10 Things Every Child Needs *McCormick Tribune* 1. Interaction* 2. Touch 3. Stable relationships* 4. Safe environment 5. Self-esteem 6. Quality child care 7. Play 8. Communication 9. Music 10. Reading	Seven Human Needs *Holocaust Survivors* 1. Security* 2. Acceptance 3. Belonging* 4. Self-determination 5. Structure* 6. Purpose 7. Validation	

NOTE: Items marked with an asterisk (*) are repeated.

these ideas in my own classroom and spoken to other teachers who have used these and other comparable methods. Students have told me what a difference being in my classroom has made in their lives. I am not proclaiming any miracle cures for our society. I have seen these strategies make teachers' and

students' journeys through school become more positive emotional and cognitive experiences.

As a teacher who studies current brain research, I know I need to first look at the biology of the brain. What is going on in children's heads? What parts of the brain are involved in the ability to overcome obstacles? What chemicals are being released that would make a difference? What are the odds that students could learn the behavior necessary to be resilient and successful?

The 1990s, the "Decade of the Brain," brought about enormous amounts of information concerning brain growth, function, and development. The field of neuroscience has grown rapidly, and new brain-imaging techniques have brought about exciting discoveries. The money spent on research has brought us closer to cures for neurological diseases and discoveries to aid brain-injured people.

The 1990s also brought us heartbreak. Students killed students and teachers in a number of horrible incidents. Such senseless tragedies need to be understood and prevented in the future. We must be able to understand how our children feel and think and be able to know what we can do to keep them from feeling alienated. One study determined that more than 135,000 students bring weapons to school (Cohen, 1999).

Connections between a child and school and a child and his or her family have been shown to protect against stress, suicidal thoughts, violence, and the use of cigarettes and illegal substances (Klein, 1997). The family has changed. There are many reasons for the changes that have occurred. World War II caused the first of them. At that time, many women went into the cities to do the work that men had traditionally done. This began a deterioration of the extended family. Families who had been living close to their relatives now had no one to talk to or turn to for help in raising their children. Aunts, grandparents, or cousins were not available for the children when Mom and Dad were away. Along with the distance of family members came a loss of responsibility. In rural areas, children had been given chores or tasks to perform to help the family run smoothly. In the cities, many lived in apartment buildings where few of these duties were needed. Children began to feel less connected to their families and less useful (Glenn, 1989).

The trend continues today. Families seek employment opportunities away from their relatives, many families have both parents working, and there are also many single-parent families. The children are left to fend for themselves. Many students get themselves up in the morning, dress, eat, and get themselves to school. For some of them, the morning begins with negative remarks from parents who may be getting ready for work or sleeping in because of a late shift. They carry that negativity to school with them. They

may talk to themselves, putting themselves down and wondering why they were ever born. At school, they may turn an innocent incident into something much bigger. For instance, just walking down a crowded hallway could create some shoulder bumping or pushing. This type of student may overreact in such a situation and take the anger or frustration from his home condition out on another student. Perhaps the student will then say something inappropriate to a teacher. By the end of the day, the child could be suspended because he or she could not handle certain social situations when confronted with them.

Marketing consultants have discovered the needs of the child in the new millennium. They work at developing ideas that could help children meet some of those needs. Realizing that parents are inaccessible to many youngsters, they may design a doll to look like "Mom" (Adler, 1998)! Companies see a market for such products because so many children long for human contact, especially from their parents.

If students are not being taught appropriate social and emotional skills at home, it behooves us as educators to provide them at school. What I propose is not a curriculum. It is a way of classroom life that affords students the emotional and academic support they need to thrive on their journeys through school and through life.

If students are not being taught appropriate social and emotional skills at home, it behooves us as educators to provide them at school.

Last year, I received an award from a former student. A graduating student council member gives the award to the teacher who most affected his or her life. Tears started streaming down my face when Vinnie handed me the small plaque. The student council advisor read an essay Vinnie had written, which explained why he had chosen to give this award to me. I looked into Vinnie's eyes and remembered a particular day during his eighth-grade year. I was driving to school and saw several students "hanging out" near a doughnut truck. I smiled and waved, but the boys turned away. When Vinnie came into class, he was more active than usual. As he tried to make himself sit down and be still, I walked over and asked, "What's up, Vince?" He looked into my eyes,

and I saw an excited but scared young boy. He continued to jiggle and wiggle in his seat but said nothing.

Later, when I passed him in the hall, he hung his head. I called Vinnie in after school and asked him if he wanted to talk about anything. As he sat with his size-12 feet hanging out into the aisle, tears came to his eyes, and he told me of the "doughnut heist." The boys had taken doughnuts off the truck, eaten too many, and were hyped up the entire day. Vinnie's remorse was genuine, and he began to share the rationalizations he had used earlier to convince himself that what he had done was justified. His parents were divorcing. Mom was going back to school and working. Dad was living with a woman who had several children, and he never came around anymore. Vinnie was on his own in the morning and decided this would be a quick and easy way to get breakfast. He looked up at me. "Mrs. Sprenger, are you going to tell?"

I knew I had several options. This was a Catholic school, and I could easily give this information to the priest, and he would handle it. This was one of the hundreds of decisions teachers have to make every day, and I honestly did not know what to do. If Vinnie were my son, Josh, I would have several punishment to dole out, a husband to help make the decisions, and the power to have Josh work off the amount of money he had taken in doughnuts and pay back the doughnut man. Making him worry about whether the doughnut company would press charges was also an option. But this was not my son. This was one of my "kids." I feel as if he's mine when we're at school together and in other social situations when his family is not around. I had to quickly make a choice that I thought would affect Vinnie in a positive way for the future. I wanted to be someone he could trust at this time in his life when he felt others were abandoning him, yet I did not want to encourage dishonesty and theft. I told Vinnie to come in after school for the following week. He was to bring Joey, one of the other students I had recognized, with him.

I put the boys to work. They cleaned, dusted, vacuumed, moved books and bookcases, and cleaned the toilets in the school. When others asked why I was having them do this, I simply replied, "These boys owe me." When the week was up, I took the boys and the money I thought they had earned to the doughnut shop. The boys apologized and paid the owner. They promised not to do anything like it again. I explained to the man that the boys had worked hard for the money and I was willing to vouch for them. There would be no future "heists" from these two. We were lucky. The man was kind and thanked us.

I didn't stop there with Vinnie or Joey. The boys often stayed after school, helping with chores or just talking. To my knowledge, they never got into trouble again. I asked the priest to talk to Vinnie about his problems at home, but

he seemed to be happier in the classroom than being pulled out for these discussions.

The boys graduated from grade school in May. I wanted to leave one last impression on Vinnie. He had so much potential, and his home life had improved very little. I asked him to lunch during that summer. I picked him up, took him to a nice restaurant, and bought him whatever he wanted. We spoke of his future plans, and I reminded him of his potential and my faith in him.

I didn't see Vinnie for 3 years after that. I ran into him at a basketball game, where he was watching his girlfriend cheer. He came over and hugged me and said things were going well. He introduced me to his girl: "This is the teacher I had who took me to lunch." They hurried off, and until he walked into my classroom with the plaque, I hadn't laid eyes on him. He was still growing, ready to graduate from high school, and heading for a university.

I took that plaque into my classroom and hung it on the wall, where four others were already hanging. A colleague who had just seen the presentation of the award stuck her head in my doorway. She asked the rhetorical question, "What do you *do* to those kids?"

Follow me down the Yellow Brick Road and I will show you.

Wizdom

- The overlapping needs appear to be *choice, a sense of control, social support,* and *interaction.* Does your classroom provide these?
- What other areas can you support in your classroom? *Predictability and safety, assigned responsibility,* and *emotional and physical outlets* may already be incorporated in your learning environment. If they are not, consider how you may include them as you progress through the book.
- As you continue to read, look for specific strategies you would like to try. Incorporate them slowly, one at a time, and let yourself become comfortable with each before you add the next.

2

Following the Yellow Brick Road: Understanding Brain Structure and Function

But it is a long way to the Emerald City,
and it will take you many days.

—A Munchkin

I am giving one of my brain research seminars in the Midwest. One of the participants comes to me the day we have finished discussing brain structure. She begins, "I have a story you may want to share at future classes. My son was born with only one hemisphere of his brain." Although I have read about such situations, I had never known anyone who had lived through it. My heart immediately goes out to this woman.

"His left hemisphere was developed, but he had no right hemisphere. His skull was filled with fluid, and the doctors had to give him a shunt to drain some of it."

I wait for her to continue. She had spoken of her child only in the past tense. I do not want to say anything to upset her.

"He is really doing fine now. The left hemisphere took over the functions of the right. His left arm and leg are smaller than his right. He walks with a limp, but when he runs, you can't even tell there is a problem!"

I breathe a sigh of relief. I am eager to ask her a million questions, but I resist. In the continuing conversation, I discover that her son is a senior at the same university that my daughter, Marnie, attends.

If the Emerald City is the place where the answers to the future lie, it must be like the marvelous and most intricate structure in our bodies and perhaps even in the universe: the brain. To understand the journey that each child takes, we must first understand how the brain develops and functions.

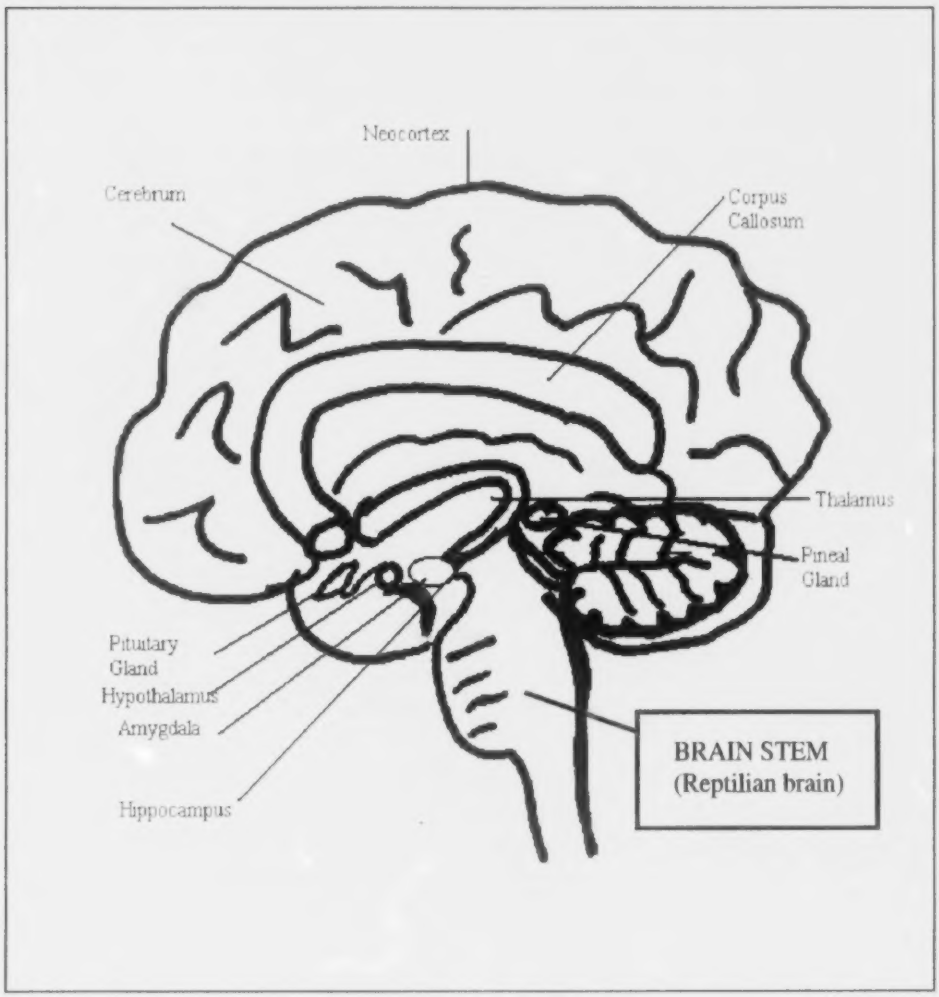
Basic Brain Structure

At birth, the brain weighs about 1 pound. It doubles in weight during the first year of life and reaches about 3 pounds by adulthood. The adult male brain weighs more than the adult female brain, but size does not seem to affect intelligence. The brain is about 2% of the body's weight; however, it uses from 20% to 25% of the body's energy. It has the consistency of loose gelatin, and although the outer layer has been called *gray matter,* it is really a pinkish-brown color.

The human brain differs from the brains of other species in two important ways. First, the human brain has a larger cognitive area and the ability to use it for higher-order thinking. Second, in most other species, the offspring are born with almost fully developed brains, whereas the human brain requires nurturing for 18 to 20 years (Sylwester, 1997a). This is not full development, however. It has recently been discovered (Talaga, 2000) that the brain is not fully developed until sometime between the ages of 22 and 35!

One of the more simplistic ways of looking at the brain is to divide it into three areas as Dr. Paul Maclean did in his triune brain theory (Hooper & Teresi, 1986). Keep in mind that the brain is part of a brain/body network that constantly exchanges, processes, and stores information (Pert, 1997). Although the Maclean theory is quite elementary, as a metaphor it is still useful. When I use this theory in my classrooms (both elementary and graduate classes), I explain that, although it may be overly simplistic relative to the Decade of the Brain discoveries, it may be useful for our purposes. The basic understanding

Figure 2.1. Parts of the Brain
NOTE: This figure shows the brain stem, limbic structures, and neocortex.



of how the brain areas work together provides a "big picture" for my global learners. I extend this metaphor with the brain structures that fit into each area (see Figure 2.1).

The lowest area of the brain, the area where information enters, is called the *brain stem*. Maclean called it the R-complex or the reptilian brain (Hooper & Teresi, 1986). This area regulates functions such as breathing, heart rate,

metabolism, and the waking and sleeping cycles. If we look at the structures in the reptilian brain, we find the medulla oblongata, the pons, and part of the reticular activating system. The reptilian brain is set for survival. In a crude sense, it is in charge of the brain's responses. Although we now know that the amygdala and hypothalamus, structures in the limbic area of the brain, actually set off the *flight or fight* response, the reptilian brain has long been credited for controlling this response. In an evolutionary manner, it is thought that this brain developed first. It appears to be very hard wired, ritualistic, and repetitive. It is often called an instinctual brain.

The next area, above the brain stem, is called the *limbic* area. This area is touted as controlling the emotions. It does much more than that; it also helps in the storage of many of our memories. The limbic system, as it is sometimes referred to, contains the hippocampus, amygdala, thalamus, hypothalamus, pineal gland, pituitary gland, mammillary bodies, and the cingulate gyrus. The thalamus sorts information coming into the brain, and the hypothalamus regulates information from within the body. When factual information enters the brain and is important enough to be stored in long-term memory, the hippocampus is the structure that allows this to happen. If the information is emotional and is to be stored, the amygdala is in charge of this storage process. The limbic system is often called the mammalian brain. It is the second brain to evolve and has learning capacities that the reptilian brain does not. Maclean called it the *emotional brain* (LeDoux, 1996).

The reptilian brain and the limbic brain have been connected with the decision-making process while encountering stimuli. It is thought that the primitive area of the brain looks at information to determine whether to run, fight, or mate (Sylwester, 2000). The definitive solution lies with the two systems working together, sometimes making split-second decisions for survival.

The next layer of the brain is the *cerebrum*. This is divided into the right and left hemispheres. The cerebrum itself is often referred to as our *white matter* because it is white from a coating of myelin, the fatty substance that covers some brain cell connections. The cerebrum is actually a collection of the connections that send messages from the brain to the body. The two hemispheres are connected by a band of fibers called the *corpus callosum*. This band enables communication between the two sides of the brain. Some studies suggest that a woman has a larger corpus callosum and therefore is able to switch back and forth more quickly.

The cerebrum has a thin cover, about 1/8th of an inch thick. This is the *neocortex*, which means *new bark*. It is sometimes called the cerebral cortex and is the layer that does the thinking. This area is our so-called gray matter. It

invents, creates, writes, calculates, and gives us many of the wonderfully human attributes we possess. We know that the left and right hemispheres have different functions. The left hemisphere is in charge of speech, logic, sequence, time, details, and math. The right hemisphere is related to music, art, strong emotional responses, intuition, images, and summarizing. I teach my students to remember that the left hemisphere deals more with parts, whereas the right deals with wholes. These two work together very well to make life complete.

The hemispheres of the brain are also divided into lobes. The occipital lobes, at the back of the brain, process visual information. The temporal lobes on the side, above the ears, process auditory information and some memory. The parietal lobe, on the top of the brain toward the back, is in charge of feeling and touch. The frontal lobe, at the front of the brain, deals with decisions, planning, creativity, and problem solving. The prefrontal area, which is right behind your forehead, is an important area that deals with emotions, personality, working memory, attention, and learning.

We must not forget the *little brain* at the back and beneath the occipital lobe. This is the *cerebellum*. In the past, it was thought to be responsible only for posture and balance, but current research suggests that it stores certain memories and may have other functions as well (Sprenger, 1999).

We can look at brain processing simply as it follows a path:

1. Information enters the brain through the senses.
2. All sensory information except the sense of smell goes to the thalamus.
3. The thalamus sorts the information to send it to the various areas in the cerebral cortex.
4. Visual information goes to the visual cortex in the occipital lobe. Auditory information goes to the auditory cortex in the temporal lobe, and so on.
5. If the information is important and factual, the limbic structure, called the hippocampus, catalogs it for long-term memory.
6. If the information is important and emotional, the limbic structure, called the amygdala, catalogs it for long-term memory.
7. In the neocortex, the information is examined and worked through for pattern and meaning.

At the most basic level, this is how learning occurs. If it always worked this simply, life would certainly be good. However, the journey through school and through life is filled with changes, surprises, and unexpected challenges. The Yellow Brick Road can be bumpy.

Brain Cells

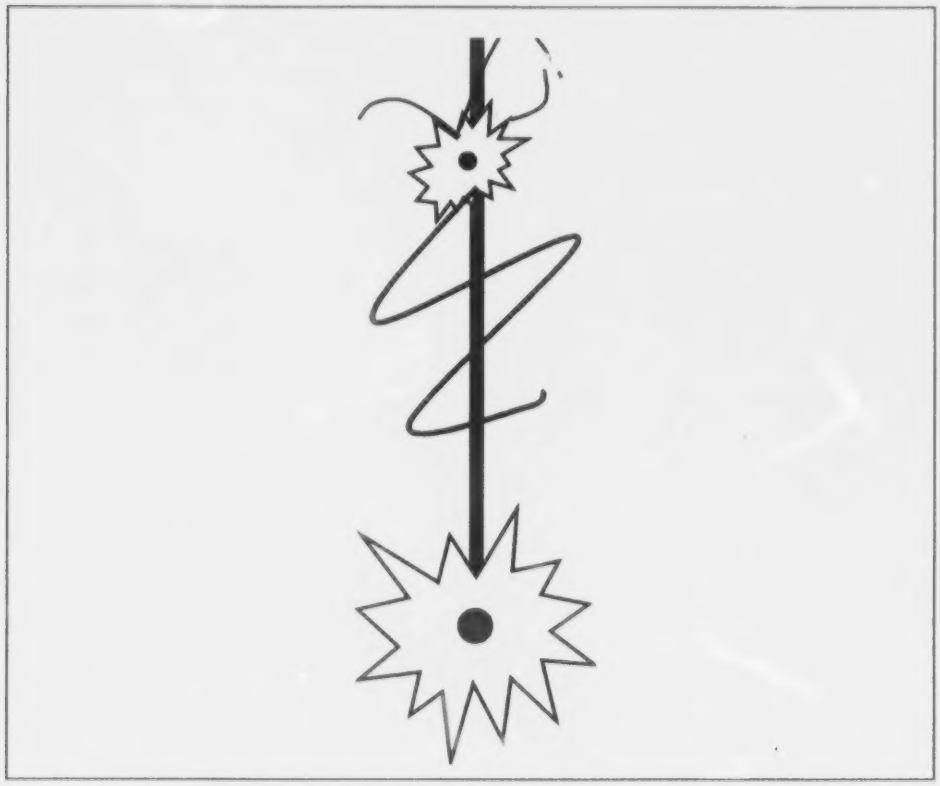
Now that we've taken a brief look at the basic structure of the brain, let's look at what makes up those structures. The brain contains many different kinds of cells. *Glial* cells feed other brain cells. They are nurturing cells and allow the learning cells to work to their capacity. Recent research suggests that glial cells may assist with the transmission of messages. They are sometimes called *interneurons*. Without the glial fiber (see Figure 2.2.), the brain cells would not be able to migrate to the appropriate areas (Kunzig, 1998).

Other work of the glial cells, of which there are several types, is transporting nutrients, holding neurons in place, and digesting parts of neurons that are incapable of further activity (Chudler, 1999). One type of glial cell provides the fatty substance called myelin, which coats parts of other cells. The type of cell basic to learning is the *neuron*, or nerve cell. A baby's brain contains about 100 billion neurons at birth. Many of those neurons are used, and some of them never make connections and remain unused. Because the brain works according to a "use it or lose it" rule, unused neurons may become useless. That is not to say that we "lose" them altogether; they simply lose their ability to learn (Diamond & Hopson, 1998).

Learning takes place when two neurons communicate. To understand how they communicate, we must first look at the structure of the neuron. The neuron has a cell body. It may begin its life simply, looking something like a ball. When the neuron begins to get information, it grows appendages called *dendrites*. Dendrites receive information for the neuron. After information is received, it is sent to the next neuron via a formation called an *axon*. Neurons may have numerous dendrites, but they have only one axon. When two neurons communicate, information goes from the axon of the sending neuron to the dendrite of the receiving neuron (see Figure 2.3). A tree might be a good representation of a neuron. The trunk would represent the axon, and the branches of the tree would be the dendrites. Information enters the branches, goes through the cell body, down the trunk, and exits through the roots. Just as the tree has several roots, an axon may grow small appendages, called axon terminals, to help accommodate numerous transmissions.

Figure 2.2. Neuron Traveling Along Glial Cell Fiber

NOTE: This figure shows a glial cell with a neuron traveling up its fiber to migrate to the appropriate place in the brain.

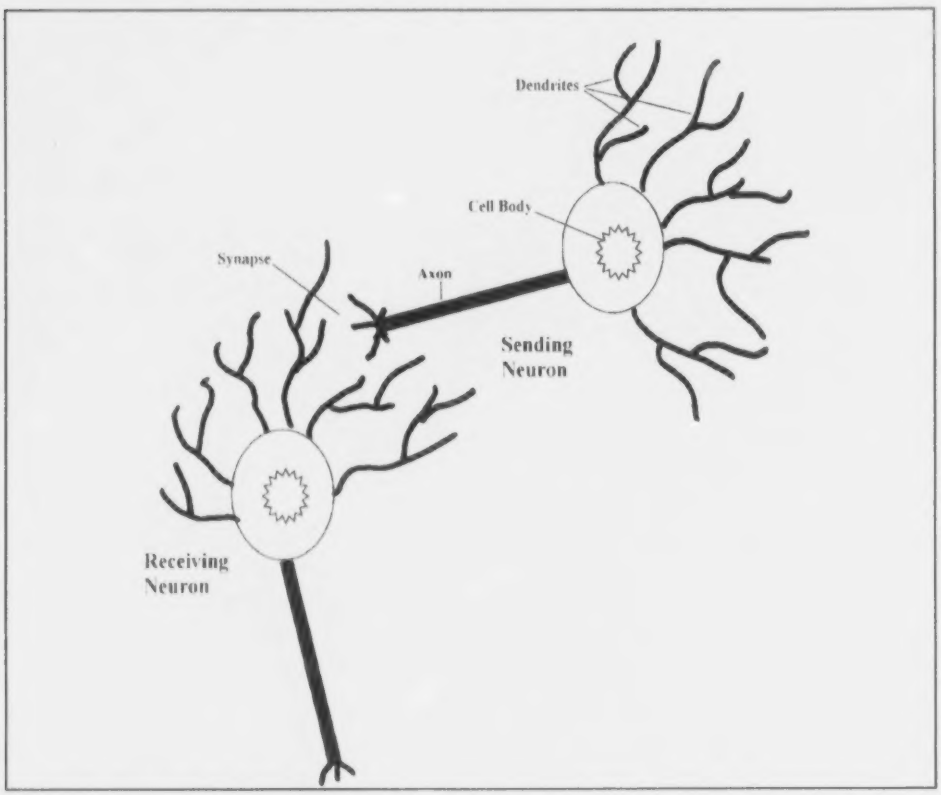


Learning takes place
when two neurons communicate.

Dendrites are always looking for information because the brain wants to learn. The dendrites themselves may grow appendages that also have dendritic capabilities. There may be several levels on a single dendrite. It is sometimes hard to see the strong desire of the brain to learn in our classrooms; however, the brain is always searching for meaning.

Figure 2.3. Neurons Communicating.

NOTE: When neurons communicate, learning takes place. Information goes out through the axon of the sending neuron, crosses the synapse, and attaches to the dendrite of the receiving neuron. The receiving neuron sends the message through its cell body and down its axon to continue the process.



There is always a gap between the axon of the sending neuron and the dendrites of the receiving neuron. This gap is called a *synapse.* Its purpose is simple. The messages sent from neuron to neuron are chemical. These chemicals, called *neurotransmitters,* must cross the synapse to the next neuron. Many neurotransmitters are found in the brain, and neurons can receive messages from many different neurons; the space allows many messages to be received. When neurons continually communicate with each other, a neural network is formed. The more this network is used repeatedly, the more quickly

and smoothly the messages are transmitted. When a neuron sends a message to another neuron, it is said to *fire*. If the message I am receiving is "Cows give milk," many neurons must connect for that message to be understood in my brain. As this fact is conveyed throughout my lifetime, these neurons fire together repeatedly. They eventually become so accustomed to firing together that it would be difficult for me to change this information in my brain if I were to discover this information to be false.

Myelin

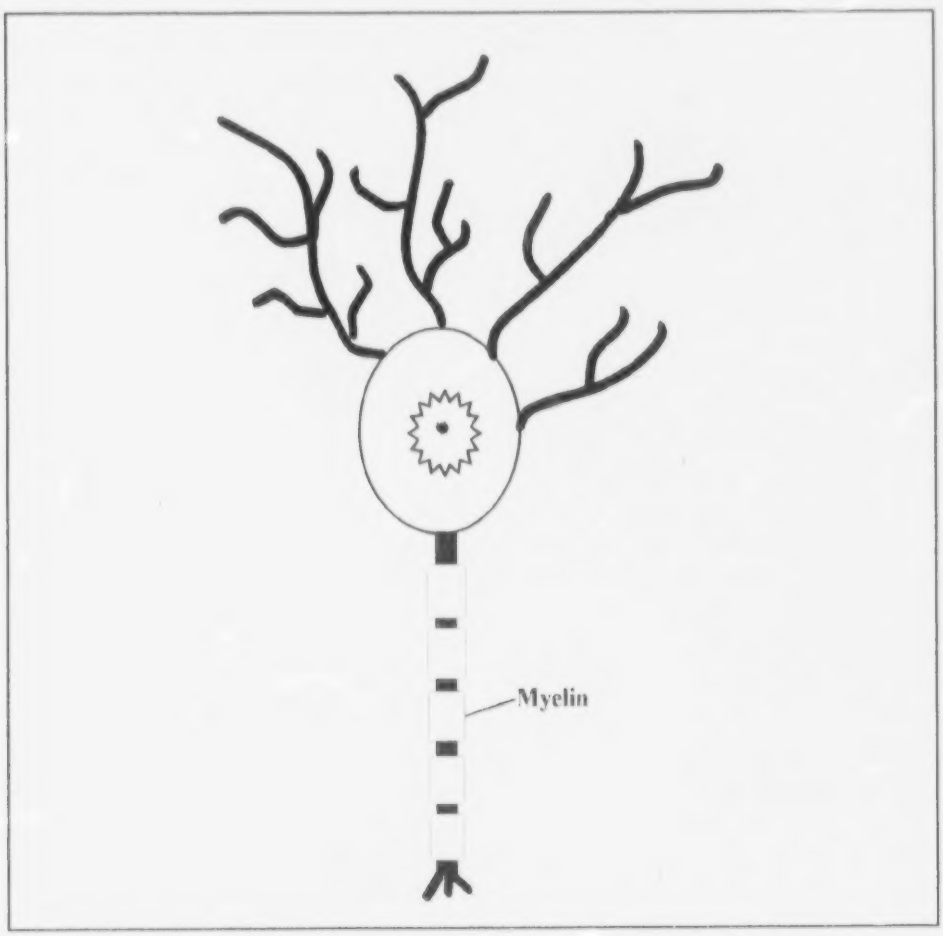
The substance called myelin is released at different stages of development. This fatty substance coats most axons to help transmit messages. Myelin coats specific brain areas in a developmental fashion. For instance, it begins with the back of the brain, and the final bursts of myelination occur in the frontal lobes, which is the last brain area to fully develop (see Figure 2.4).

The myelin coating, which has been compared to insulation on electrical wiring, does not cover the axon like a tube. It looks more like link sausage on the axon. This is because messages within the neuron are electrical and the impulse travels on the outside of the axon in a process called *saltatory conduction* (Chudler, 1998). The message travels down the axon, aided by the white myelin coating. At the tip of the axon, the electrical pulse causes vesicles within the axon to release the message in the form of a chemical neurotransmitter. Until all the areas of the brain are myelinated, there may be difficulties learning in the areas waiting to be developed. For instance, the prefrontal cortex is the last area to develop fully. Keeping this in mind, we cannot expect students who have not reached this developmental stage to have all skills and functions accorded to this area at full development. Hence analysis, synthesis, decision making, and future planning may be delayed in some students.

Plasticity

The brain has the amazing ability to change. To indicate this capability, it is said to be *plastic*. Plasticity allowed the woman's son with only one hemisphere to function almost perfectly and have a normal life. As the brain develops in the womb, the growing neurons travel along the glial fibers to their new "homes." These are specific areas of the brain where they will function. For quite sometime, however, they remain uncommitted to this space and may be

Figure 2.4. Neuron With a Myelin-Coated Axon
NOTE: Neurons are myelinated as part of the development process.



used elsewhere (Neville, 1997). The single hemisphere of the child described at the start of this chapter used the neurons for almost all necessary functions.

The brain has the amazing ability to change.
It is said to be *plastic*.

The younger the individual, the easier it is for the brain to make these changes. It is still possible for neurons to take on new responsibility later in life. This happens in brain damage from accidents and stroke. Although neurons may be destroyed by the damage, in some instances, therapy allows the victim to regain some of the lost brain function.

Plasticity accounts for learning as well. Researchers Marian Diamond, of the University of California at Berkeley, and William Greenough, of the University of Illinois, have been doing experiments with rats for many years (Diamond & Hopson, 1998). They have discovered that old rats can grow new dendrites in an enriched environment. An enriched environment for a rat includes cage mates and challenging toys. After living in this kind of environment, the rats learned faster. Their learning consisted of running mazes. Others, such as Dr. Craig Ramey of the University of Alabama, have carried this research into the human world. Ramey studied children taken from poverty and placed in enriched environments that included proper nutrition, stimulation, playmates, and challenging things to do. They showed a remarkable increase in test scores compared with his control group (Kotulak, 1996).

Chemical Messengers

Just as Dorothy received information from many of the inhabitants of Munchkinland, many chemical messengers carry varied information in the brain. From 60 to 100 neurotransmitters have been identified. For my purposes, I will discuss only a few that we know affect learning and attention.

Serotonin. This neurotransmitter has been associated with many problems. It has been linked to depression, migraines, premenstrual syndrome, attention deficit disorder (ADD), obsessive-compulsive disorder, and aggressive and violent behavior (Niehoff, 1999). Serotonin is produced in the brain stem and is distributed throughout the brain, especially in the emotional areas. It helps cells communicate smoothly; their transmission becomes effortless with the appropriate amount of serotonin. Too little of this chemical causes depression and sometimes violence.

Positive feedback has been suggested as a possible solution to low serotonin levels. In several studies, it was found that individuals with high self-esteem also had high levels of serotonin in their systems. They were found to be socially adept and happy people. Those with low self-esteem had low levels of the chemical, were unhappy, and had difficulty handling relationships. In

extreme cases, these students were impulsive, aggressive, and sometimes violent (Sylwester, 1997b). After receiving positive feedback, some students with lower serotonin levels not only raised those levels but also began getting along with others.

Critical cases could lead to depression or violence that would probably need to be controlled with medication. Antidepressants are often used successfully because they allow more serotonin to flow freely in the necessary areas of the brain. The aid the neurotransmitter gives messages allows for clearer thinking. It is especially important in the communication between the limbic system's amygdala and the prefrontal cortex. The prefrontal cortex helps the amygdala regulate its responses (Goleman, 1998b).

Norepinephrine. This neurotransmitter is sometimes called noradrenaline. It is manufactured in an area of the brain stem called the locus coeurelous and is released in a smooth, easy rhythm until something alarming occurs. At that point, the chemical is released in abundance and floods the hippocampus, hypothalamus, amygdala, and the cerebral cortex. This is a signal of alarm and causes the brain to prepare the body for flight or fight.

Too much norepinephrine may cause aggressive behavior; however, low levels of this chemical may cause an individual to seek thrills, which will then trigger the release of norepinephrine in the brain (Kotulak, 1996; Rupp, 1998). Career criminals have been found to have low levels of norepinephrine. They appear to lack displays of emotion or remorse (Kotulak, 1996). This neurotransmitter plays a role in attention and learning, as well as being a memory enhancer (Barnet & Barnet, 1998).

Dopamine. This is the reward chemical. Dopamine is the neurotransmitter with the attitude "If a little is good, a whole lot must be better." Released from a brain stem structure, the substantia nigra, dopamine is critical to voluntary movement. A lack of dopamine causes the symptoms of Parkinson's disease such as tremors and stiff movements.

Dopamine is also vital to helping you direct attention and make decisions. When working memory is trying to make a decision, dopamine inhibits other stimuli in the prefrontal cortex. After considering options in a possible emergency situation, dopamine inhibits the leftover possibilities once the final decision is made. It also balances the excitatory and inhibitory chemical conditions in this area, which affords working memory the opportunity to comprehend. An imbalance of dopamine in the prefrontal cortex could cause disruptions and incompetence (Niehoff, 1999). This is one example in which norepinephrine and dopamine work on the same situation. Norepinephrine is the chemical that made you aware of the problem, and dopamine helps you solve it.

A lack or imbalance of dopamine in the prefrontal cortex can be a problem for some students. Because this is the area for decision making and attention, these students may have difficulty planning ahead on simple tasks, such as remembering needed supplies for class (Jensen, 1999). As a result, they may cause some disruption. Because of the need for dopamine, they may also seek movement and thrills. Each of these activities would cause the release of the chemical.

Acetylcholine. Involved in many situations, acetylcholine is released every time you move a muscle in your body. It activates the muscle fibers. This chemical is also involved with the sleep stage called rapid eye movement (REM). Dreaming occurs during this phase of the sleep cycle. Finally, acetylcholine is very involved with learning and memory. Long-term memories could not be established without its release. In Alzheimer's disease, the production of acetylcholine may be down 90% in areas such as the hippocampus. Many of the drugs being developed to fight the symptoms of the disease are designed to produce more acetylcholine in the brain.

Endorphins and enkephalins. These two chemicals are examples of peptide neurotransmitters. They are found in several areas of the brain and are also produced by the pituitary gland and released in the body as hormones. They are both part of the brain's endogenous morphine system, which consists of chemicals made in the brain and body to alleviate pain. In survival situations, many people report feeling no pain from injuries during the period of time in which they were escaping danger. This is due to the work of these analgesics. This same "numbness" may be felt in emotionally stressful situations (Niehoff, 1999). When endorphins and enkephalins enhance the release of dopamine, they are also involved in pleasure (U.S. Department of Health and Human Services, 1993).

Amino acids. Gamma-aminobutyric acid (GABA) is a neurotransmitter in the brain that reduces anxiety. Because it keeps certain neurons from firing, it is called inhibitory. GABA is found in abundance in the prefrontal cortex. Its job is to send a "No" signal to neurons that should not fire.

Glutamate is the most abundant excitatory neurotransmitter. It sends the "Yes" message to neurons to make them fire. "Yes" and "No" chemistry sends many of the messages in the cortex. Glutamate is formed in the hippocampus of the brain and is responsible for all the messages in that structure. This important chemical can perform both positive and negative functions in the brain. When damage is done to the brain, such as from a stroke, glutamate is heavily released from the neurons and can eventually kill other brain cells (Pert, 1997). It has also been found to work with cortisol, a stress chemical, and cause damage to the hippocampus (McEwen, 1999).

The combinations and perfect balance of these chemicals affect and are affected by every thought, every word, and every action. Norepinephrine, dopamine, and serotonin are vital to the message control in the cortex. Like air traffic controllers, they slow down some messages, speed up others, and help each transmission land safely so that appropriate action can take place. Too little of these chemicals will cause an inefficient system—too much, and chaos could ensue. These "Munchkins" keep the travel on the Yellow Brick Road moving along at a steady speed.

The combinations and perfect balance of these chemicals affect and are affected by every thought, every word, and every action.

The Road Home

The purpose of this tour of the brain is to provide you with the basics as we examine the child's journey. These brain basics will help you understand the obstacles that the Cowardly Lion, the Tin Man, and the Scarecrow may encounter as Dorothy takes them on her journey. The three characters are all parts of any child. Dorothy needs to understand each of them to cope and be successful. Home is a place from which to begin a journey, and Dorothy leaves hers to discover a destination that will also feel like home. Baseball players must touch all the bases before they can go to home base, where they can score and feel like winners, and Dorothy must cover the bases that will lead her to the success she seeks. She hopes this new home will provide her with the protective factors that will assure her success. Let's continue down the Yellow Brick Road and see where it takes us.

Wizdom

- Because we know that the brain/body network has an instinctual need, an emotional need, and a cognitive need, we must provide for those needs in the classroom.

- The brain/body chemical balance is affected by everything we think and do. As you read, decide which classroom applications might have positive effects on chemical balances.
- As educators, we must keep ourselves current as new discoveries are made. Become familiar with credible sources for current research. The following Web sites may be helpful:

www.aan.com	American Academy of Neurology
www.dana.org	Dana Alliance for Brain Initiatives
www.sfn.org	Society for Neuroscience
www.brainconnection.com	Brain Connection

3

If I Only Had the Nerve: Dealing With Stress

"But that isn't right.
The King of Beasts shouldn't be a coward," said the Scarecrow.

"I know it," returned the Lion, wiping a tear from his eye with the tip of his tail. "It is my great sorrow and makes my life very unhappy. But whenever there is danger, my heart begins to beat fast."

The king of the jungle is describing *stress.* It has become a negative word in our vocabulary since Dr. Hans Selye first coined it decades ago. Stress, however, is not necessarily a bad thing. Life would not be very exciting without a little stress in it. What we have commonly called stress covers several types of situations and has been defined by Selye as *a nonspecific response of the body to a demand* (Sapolsky, 1998). What is problematic about stress is that one person's biggest nightmare is another's greatest pleasure. For instance, my husband has a private pilot's license. Scott loves to fly small planes and does so for relaxation and fun. I, on the other hand, am as happy about flying with him as I would be about jumping off a very tall building! Needless to say, he flies without me. Scott experiences *eustress,* or positive stress, from flying, and I experience *distress,* or bad stress, from the same experience. Sometimes it is difficult to determine the difference between the two.

I am a freshman in college. This is my first time away from home, and I am nervous and very excited. Mom and I are very taken with the university recruiter, John. She likes him because he is knowledgeable and charming, and I like him because he is blonde and beautiful!

We are unpacking the car in front of my new home: Woody Hall. It is an old building with community bathrooms, but I feel at home here. As we drag my trunk from the car, John suddenly appears.

"Can I help you?" he gallantly offers.

Mom does not like to lug anything. "Grab the other end and lift," she commands. Together, they take the trunk to my room. When everything is unloaded, John smiles politely, wishes me luck, and leaves. That's okay because I am still grieving about leaving my boyfriend at home.

Two nights later, John calls. "I know it's your birthday on Saturday. Are you going home?" he asks politely.

"No, it's too soon to leave," I reply, with a pounding heart.

"How about if I take you to dinner on Saturday to celebrate? Or do you have other plans?"

My racing heart kicks up the speed, and I breathlessly reply, "That sounds great!"

We arrange for him to pick me up at the dorm at 7:00. I tear around my room in a tizzy on Saturday. I can't decide what to wear, how to act, or what to order. I know I have to order coffee. That would be the grown-up thing to do. After all, John is about 23. He would only be interested in a woman!

When my room is buzzed at precisely 7:00, my heart jumps. Seeing John in the lobby causes my knees to wobble, and my mouth feels as if it is full of cotton. He whisks me off to the only decent restaurant in this college town, the Holiday Inn. I immediately have evil thoughts of John getting a motel room. How will I turn this handsome man down? What would a mature woman do? He escorts me into the dining room. When the waiter approaches and asks if we would like something to drink, I promptly reply, "Black coffee, please." John asks for a Coke! (Oh, how I would love to have a Coke!) We order steak dinners. I don't eat much; my appetite is gone.

I imagine him taking me either to a room after dinner or to his apartment. I think his bachelor pad must be very masculine and probably a den of iniquity. After finishing dinner, we get into his yellow convertible, and he takes me . . . straight back to the dorm, wishes me a happy birthday, and leaves.

I climb the stairs slowly. My heart finally slows to a normal beat, and I can swallow again. It was a perfect evening.

That date was a memorable experience for me. One of the reasons I remember it so vividly is that I was undergoing a mild stress response. The symptoms of this brain/body response were my racing heart, dry mouth, and wobbly knees. The chemicals that were circulating in my brain helped me take this memory from short-term to long-term storage. They *marked* this experience for me in such a way that several years later when I saw John again, I had a similar response.

This is an example of the positive stress response, or eustress. Our response system was designed to keep us alive. It was intended to get our bodies prepared to flee or fight. At this milder level, it simply keeps us on our toes. Some of us experience this response when we go to the dentist. It is also prevalent at a job interview. Because these experiences in our lives are intermittent and random, they do not cause us to be in the state of stress or distress in which the Cowardly Lion lived. I like to say that anyone in this constant distressed state has his or her "alarm button on."

Sally is a sixth grader in my language arts class. A very delightful child, she has a smile on her face most of the time. She has a nice circle of friends, participates in basketball, and takes piano lessons. Sally's parents are volunteers at school whenever they can be away from their jobs. Sally's dad works for a large company and may be transferred at any time. Her mother is a secretary at their church.

Sally begins to miss school occasionally. She returns with dark circles under her eyes. Makeup work is difficult for her to complete, and her grades begin to suffer. She begins to miss more school, and her parents call for a conference. Rather than talk about her illness, they want to know only how she can bring up her grades. They say they will punish her and keep her off the team if that is necessary. Alarmed, I encourage them to refrain from any form of punishment. Perhaps Sally can stay after school a few nights and make up her work. Mom and Dad leave still visibly upset.

More days are missed, and Sally returns looking tired. She is coughing and has great trouble controlling it. She is no longer socializing with her friends. They try to get her to go with them at recess and during gym, but she avoids them and spends some of her time in my classroom, just sitting. She doesn't speak, and I don't intrude on her privacy.

> Friday is our writing workshop time. Today, we are going to do some creative writing. I turn on classical music that includes nature sounds. One of the students suggests that I turn off the lights while they visualize the scene, and I do so.
>
> Sally gives an audible gasp, jumps out of her seat, and leaves the room. We have no counselor, so the principal and I retrieve the child from the bathroom and escort her to the office. She sits with a look of terror on her face. Eventually, weeks later, she reveals the horror of her abuse. The perpetrator is not either parent. He is a neighbor who follows her into the house after school. Some of her absences have been attempts to keep the house locked and the intruder out. The cough and other illnesses are the results of not sleeping as she tries to solve her problem and keep her parents happy. Her condition could also be aggravated by the suppression of her immune system from the stress.

Sally was living with her alarm button always on. The abuse she suffered changed her brain. She focused on protecting herself and became hypervigilant in doing so. She could no longer focus on school or her friends.

Studies have shown that abuse can cause reactions in children that are very different from those in nonabused children. This information can be noticed in the electrical activity in their brains and the chemical levels in their bloodstreams (Fauber, 1999).

Selye noticed the similarity in symptoms in stressful situations and called them the stress syndrome or the general adaptation syndrome (GAS). He distinguished three stages in this syndrome: (a) alarm, (b) resistance, and (c) exhaustion (Sternberg, 2000).

The Lion's Not Lying

A racing heart is only the beginning. Let's look at what this stress response does to the brain and the body. To understand this, you must look at the autonomic nervous system. It is divided into three more systems: the sympathetic nervous system, the parasympathetic nervous system, and the enteric nervous system. For my purposes, I will look at just the sympathetic and parasympathetic nervous systems. These two networks are important in situations that cause stress and in nonemergency situations in which we can relax. These

would be the flight or fight circumstances and the *feed and read* circumstances.

The Sympathetic Nervous System

> It is a wonderful day. The sun is shining; the sky is blue. There is a beautiful breeze that delicately blows over me as I walk down the steps to the driveway to hop in my car. I have several packages to mail and am heading to the Post Office a few blocks away. The hot, still air from the car overwhelms me as I open the door. Why drive on this beautiful day? I decide to walk. I go back in the house and get Rigby, the family dog, because she probably would enjoy the exercise as well.
>
> As we turn the corner that leads us out of the subdivision, I spy a large German shepherd, about 30 feet ahead. The dog is on the sidewalk, facing us. Rigby growls, and my heart races. German shepherds are magnificent animals, but I had an experience with one in my youth and have no intention of repeating it. Rigby has a tendency to get quite carried away around other animals, and I don't want to give her the opportunity to get me into trouble.
>
> I clutch my packages close to my chest, pull Rigby's leash to my body, turn around, and start moving back toward home. Rigby tries to turn around and barks. My mouth is dry, my heart is still racing, and I can barely catch my breath as I try desperately to not drop the packages and to pick up the pace at the same time. My side and stomach begin to hurt. Perhaps I shouldn't have had that burger and shake for lunch!

The sympathetic nervous system is engaged when emotions are charged. It is said to *sympathize* with the emotions. This is the alarm stage of the stress syndrome identified by Selye (Sapolsky, 1998). From Chapter 2, we know that normally, information enters the brain through the brain stem and goes to the thalamus, where it is sorted and sent to the neocortex. If the information is worth storing for the long term, the factual part of it goes to the hippocampus, and the emotional part is stored through the amygdala. That is what was happening before I saw the large dog. I was taking in the information from the beautiful surroundings and weather. My brain was functioning normally, and I was calm. When I saw the German shepherd, some things changed. The amygdala and the thalamus reside close to each other. It is said that there is

only a single neuron separating them. Because the amygdala is always filtering information for emotional content, it sometimes "jumps the gun" and grabs the information before the thalamus has a chance to transport it for logical reasoning in the cerebral cortex. The prefrontal cortex usually keeps the amygdala under control, but this is extremely difficult in fearful circumstances. As a result, my body and brain went through some interesting experiences. As isolated events, some of these are surprising, but to a brain in the survival mode, it is all clearly necessary and makes perfect sense.

My amygdala sent an alarm to my hypothalamus. Remember, this is the structure that manages internal messages. First, my hypothalamus sends signals to my adrenal gland to tell it to release epinephrine (also known as adrenaline) and norepinephrine. These two chemicals cause my heart to beat faster and my blood pressure to increase. They also cause faster respiration and stop my digestion. (Why digest when you are worried about being digested yourself?) The blood in my digestive tract goes to the large muscles in my legs, for flight. At this point, my hypothalamus releases corticotropin releasing factor (CRF), which goes to the pituitary gland, located in my brain, conveniently close to the hypothalamus. My pituitary gland then releases adrenocorticotropic hormone (ACTH), which stimulates the adrenal glands to produce cortisol. This pathway is commonly called the HPA (hypothalamus-pituitary-adrenal) axis.

Cortisol is a stress hormone. It increases the glucose supply to provide more energy for the brain and the heart. It also turns fat into energy and suppresses the reproductive system. As it accomplishes all these tasks, it suppresses the immune system as well (McEwen, 1999). All bodily systems sacrifice to prepare the body for what might be its final fight. The importance of immunity, ovulation, and even growth in a child pale in comparison with the task at hand.

You might think, all this because she saw a dog? Remember, this alarm system was first set up in the days of worrying about attacks by lions and tigers and bears! (Oh, my!) In the case of the German shepherd, it was quite possible that my physical presence could have been in danger.

All these systems were coming to a screeching halt as I tried to run from the dog. My brain was being bathed in cortisol, and my amygdala actually liked this very much. However, my hippocampus did not. In fact, my hippocampus can be damaged by too much cortisol and wanted to put a stop to its release. While the cortisol circulated in my brain, transmission between neurons may have been be interrupted, so I may not have been be able to "think straight." The hippocampus sends chemical messages to the hypothalamus to stop the release of CRF. If the amygdala was still sensing danger, it would

continue to send signals to my hypothalamus to continue releasing CRF. Once I was far enough away from the dog, my amygdala would feel safe enough to stop sending its signal, which would allow the hippocampal signals to take charge and stop the stress response (LeDoux, 1996).

Looking for Balance: The Parasympathetic Nervous System

When the hypothalamus stops releasing CRF, the parasympathetic nervous system takes over. This is the *resistance* phase of the general adaptation syndrome. It tries to create homeostasis, or balance, in the body and mind. My saliva production would increase, and my heart rate would decrease. I could begin to digest that lunch I had just eaten. My immune and reproductive systems would begin their normal work, and my body would work on repairing any damage done by the stressful situation.

This is an important function of the parasympathetic nervous system, and under normal circumstances, it does this well. If stress becomes chronic, however, the hippocampus may become damaged from the cortisol. This damage may cause the hippocampus to weaken and become unable to send a strong message to the hypothalamus to stop releasing CRF. The HPA pathway may then remain activated, and the overload of stress hormones can do further damage to the hippocampus. Along with damage to the hippocampus, there may also be prefrontal lobe damage that can prevent this area of the brain from performing the usual function of controlling the amygdala. Stress-related illnesses might occur because of the suppression of the immune system (McEwen, 1999). This describes the *exhaustion* stage of the general adaptation syndrome. The body cannot fight illness, irritability surfaces, and errors are made.

Embarrassment

> I am totally out of breath. Rigby is running now, and I can barely keep up with her. There is a pain in my left side from running. I quickly turn around and see that the dog is not following us. It is simply sitting in the middle of the sidewalk, sniffing the ground. I come to a screeching halt, pull hard on Rigby's leash (causing her to gag), and try to catch

my breath. As I stare at the large animal behind me, I notice a small detail—it is tied to a leash! I was never in any danger.

This is an example of the neural or emotional hijacking described in *Emotional Intelligence* (Goleman, 1995). My amygdala was sensitive to "dog information" because of my previous experiences. It started the stress response so quickly that my cerebral cortex did not have time to process any logical information. The cortisol running through my brain was interrupting normal transmission that might have given me the opportunity to take in more information (the dog was leashed) and make a rational decision (walk on the other side of the street). My alarm button was on, and my amygdala looked for trouble and found it.

"What makes you a coward?" asked Dorothy.

"It's a mystery," replied the Lion. "I suppose I was born that way."

I once heard the term *phobophobia* and thought it applied so well to many of the situations that we face. Like the Cowardly Lion, many of our students have their alarm buttons turned on. As a result, they are not only afraid, they are afraid of being afraid. My mother used to tell me that I "borrow trouble." We might say the same things about certain students. They are "borrowing trouble," "hypervigilant," or "afraid of their own shadows." These are all forms of anticipation. These students live in a state of mind that anticipates problems. As a result, they have trouble differentiating between challenge and confrontation, reward and punishment, and surprise and alarm. They do not take in information in the classroom. Some may search the classroom for threats or surprises. Others may daydream as an escape from their feelings (Brownlee, 1996). Children under stress can be found on a continuum. Some are mildly stressed, and others are seriously *distressed*.

Giving Them Courage

During my career, I found three approaches to calm the stress response in my students. The first is predictability, which, as mentioned in Chapter 1, has been defined by experts as one of the basic needs. Creating a safe environ-

ment is the second category. This pertains to emotional as well as physical safety. The final category is something I call the *back burner.* This is a way of allowing the students a temporary escape from their feelings and their problems. Let's take each one separately.

Predictability

Isn't it great to know what is going to happen? You wake up in the morning, and Mom has breakfast waiting for you at 7:00 so you can leave the house and catch the bus at the corner at 7:30. You arrive at school at 7:45 with just enough time to get to your locker, put your lunch away, and grab your books for your first-hour class. Mr. Brown is always late for class because he is having his last cup of coffee in the hall while talking to the PE teacher. He enters the room after the bell rings, and you know you can continue talking to your neighbor for another 5 minutes as he searches for the attendance sheet. This is a predictable situation that allows you to feel safe.

Life isn't always like that. I remember walking home from school with my friend, Jamie. She became distressed every day as we approached her street and even somewhat panicky as we came to her house. Many days, she would beg me to come in with her. You see, Jamie's mother was an alcoholic, so Jamie never knew when she walked into the house whether she would be greeted with hugs and kisses or with screams and slaps. Jamie loved school because she felt safe there.

I learned about predictability when I spent that summer vacation traveling and training with Eric Jensen, author of *Teaching With the Brain in Mind* and many other books. From Eric, I discovered *the use of ritual in the classroom.* I am not talking about hocus-pocus; these rituals are simple repetitive acts that become predictable. It is a stimulus-response situation. Whenever a situation occurs, a particular response will follow.

You can compare a ritual with a tradition. It is traditional on Christmas Eve for my family to be with my husband's family to exchange presents. Stimulus: Christmas Eve. Response: present exchange with the Sprengers. It is a tradition at our house to go out to dinner at a specific restaurant the night before the first day of the school year. Stimulus: eve of the first day of school. Response: dinner at Lum's. The family counts on these traditions. If they do not occur, it just doesn't *feel* right. It is very uncomfortable. Traditions are difficult to break because of the feeling of security that comes with their predictability.

Classrooms need many rituals to provide this feeling of security, which may help "de-stress" the students. I tell my workshop participants that they need to have 15 to 20 rituals in place by the end of the first week of school. If that number seems high, you may change your mind as I give you some examples. This is not a magic formula. You must decide what will work in your classroom with your children.

Classrooms need many rituals to provide this feeling of security, which may help de-stress the students.

This is what happens at the beginning of my class: As the students enter, "Be True to Your School," by the Beach Boys, is playing. I am standing at the door, greeting my students with a smile and a "Good morning!" When the tardy bell rings, I walk to the boom box and turn off the music. I turn to the students who are sitting with their teammates and say, "If you have 100% of your teammates seated and ready to go, raise your hand and say 'Yes!'" The students raise their hands, and when I see which teams do not have their hands up, I check to see who is absent. This is a quick and easy way to take attendance. Then, I say, "Turn to the person next to you and say, 'Good morning, I'm happy you're here today!'" My next step is to go to the lunch menu. I become the world's worst salesperson as I "sell" lunch. "Who wants green hot dogs today? We have greasy fries and a soggy cookie to dress up that ugly cafeteria tray! What do you say, raise your hand if you want lunch!" (Fortunately for me, the cafeteria staff never found out about this!)

In that 5-minute homeroom period, I had five rituals: (a) the music, (b) greeting at the door, (c) attendance, (d) saying something to a teammate, and (e) selling lunch. To assign rituals to situations, you must first think of the situations you might encounter in your particular classroom. Remember that these do not have to occur on a daily basis. These are rituals that fit situations. As long as you perform the ritual whenever the situation occurs, you are using this technique properly.

What will you do for someone's birthday? (I always play a silly tape of cats meowing the happy birthday song.)

What will you do for the opening of class? (I play that song by the Beach Boys.)

What will you do for the closing of class? (How about playing "Happy Trails to You"?)

What will you do when a student is going to read his or her written work aloud? (I have an "author's hat" the student must wear.)

What will you do when a visitor interrupts the class? (I teach my students to stand up and applaud! We don't often get visitors anymore unless they are hams!)

What will you do when it is lunchtime? (I say, "Turn to the person next to you and say, 'I'm hungry!'")

What will you do on a test day? (I play "Celebration" because we are celebrating our learning.)

What will you do to dismiss the class? (Turn to the person next to you and say, "'I grew dendrites today!'" Then, stand at the door and give each student a "high five" as they exit.)

What will you do on library day? Music day? Art day? Computer day?

Think about rituals that will work for you and your students. You must be comfortable with your ritual so your students will be too. Will your class become boring? Predictability puts students at ease so you can use novelty. If every day you do exactly the same thing in a very repetitive manner, both you and your students may get bored. Balance is important. Rituals make room for challenge, novelty, and a little craziness, which make the classroom fun. Can you change your ritual? Absolutely. Just keep in mind that it will take some time for your students to become accustomed to the new one, and be sure to warn them before you change. Be predictable!

So far, I have covered 18 possible rituals or situations for rituals. Get your principal involved. Ask him or her to use a specific phrase when ending announcements. Mine always says, "And have a great day!" When our principal is absent and someone else gives the announcements, the students are very disappointed if they don't start their day with that phrase. I have even had kids at the end of the day tell me that they had a rotten day and it was all because our principal wasn't there to tell them to have a great day. Predictability is that important.

In addition to rituals, classroom rules are very important. They also provide security as long as you stick to them. Be sure that students understand the rules. It is always good to have the students help you make them. Post them, send them home, and follow them. They become like rituals if you use the same consequences for breaking them.

Give overviews. Students need to know what they are going to be doing each day. Create a mind map or outline on the board each day with the schedule of events. This will help your students de-stress. Knowing what is going to happen, even if it is painful, gives students a feeling that "Okay, I know we are going to do long division today, but I can get through it." (It's like going to the dentist. If I know he has another appointment 30 minutes after mine, I can cope, knowing it won't last too long.)

Don't give pop quizzes. I hate to write in the negative, but there is no other way to put it. Don't give pop quizzes. First, they will start the stress response in some students. You will have defeated the purpose. Your stressed students will be unable to access the information they need from their cerebral cortex. Their grades will be poor, which may precipitate more stress. Second, they will not trust you. You have done something unpredictable. You have put their anticipation in motion. Will the teacher give us a pop quiz again today? You may believe that if your students think they might have a pop quiz this will encourage them to do their homework and study. It may work for some students; however, that is motivation by threat. It removes intrinsic motivation and may be more harmful than motivation by reward (Kohn, 1993).

Safe Environment

Creating an environment in which students feel physically safe is difficult after the recent shooting incidents at schools. After the Columbine High School shootings in Littleton, Colorado, I spent part of my teaching time for several days discussing safety and escape possibilities with my students. It began with many of them gathering around me in the library, getting as physically close to me as seventh graders will allow themselves to, and asking me what I would do if the situation should arise. We spoke of fear and the flight or fight response. We discussed alternate routes from the library and from our classroom. I emphasized the relative safety of our building, our PA system, and the current awareness generated by the recent incidents. They needed to talk about these issues, and by doing so, they felt safer. *We may not be able to guarantee their safety, but we can assure them of our concern for it.*

For students to feel physical safety, they must first have emotional safety with us as their teachers—their guardians for the time they are with us. This is accomplished both verbally and nonverbally. Students must know that we "walk the talk." Our words, our actions, our facial expressions, and our body language must all be congruent. A message is only 7% content; it is 38% voice (tonality, tempo, volume, and timbre) and 55% body language (gestures, position, and proximity). For this reason, teachers must say what they mean and

mean what they say. Sarcasm cannot enter the classroom. Neither the teacher nor the students must be allowed to tease or joke in any manner that might hurt someone. Your students must know that they will be supported as unconditionally as possible. Inappropriate discipline or embarrassing situations cause biological and chemical reactions. Yes, mere spoken words that are critical or sarcastic on a daily basis can change the brain. The words are converted to nerve signals that move along the auditory nerves to reach the temporal lobes. These signals are dispersed throughout the brain, and they activate specific networks of neurons. At this neuronal level, changes are made that eventually lead to changes in the nucleus of the cell, which can actually cause genes to be repressed or activated. Some of our genes would never be activated without certain conditions being present. So, if a child has a depressive gene, this situation could cause it to be expressed (Restak, 2000). Interactions in the classroom must be nonthreatening so the brain can be relaxed enough to look for patterns and make connections.

> For students to feel physical safety, they must first have emotional safety with us as their teachers—their guardians for the time they are with us.

Safety can be felt in surroundings. Is your classroom pleasant to walk into? Although many classrooms are limited to natural light, make use of what you have. Sunshine causes the release of neurotransmitters that make us feel good. Are there pictures, posters, stuffed animals, or memorabilia in your room? In 1973, I purchased a poster of a wall of graffiti. It had quotations on it, such as "I think; therefore, I am." My students love this poster. All the material on it is positive, and they think it relates to them. How about making your own with quotations from your students? I also keep stuffed animals around the room. Even high school students will occasionally grab one when they need some closeness. It makes the room look inviting—a little like home. (Once, a colleague entered my seventh-grade room and said, "This looks like a bedroom!" I took that as a compliment.) All ages of students relate to music of some kind. If you are not comfortable playing it, at least have a boom box in your classroom available for soothing music.

Accessibility to water and bathrooms creates a safer place for students. This may not seem important, but to many students it is. There are some classrooms in which using bathrooms or getting drinks are not allowed or are only

allowed at certain designated times. Keep in mind that students are not able to learn if these needs are not met. If this privilege becomes abused, issue students a designated number of bathroom passes each grading period. Unused passes may be redeemed for something special. I have even given minimal extra-credit points for unused passes. (The thought behind this is that the student was in the classroom more and probably absorbed more learning!) Humans need to drink at least eight glasses of water per day. The brain is made up of 80% water. Dehydrating the brain causes poor learning (Hannaford, 1995).

Back Burner

I stole this idea from a teacher in one of my workshops many years ago. I do not remember her name, but I want to thank her. I have used this concept ever since and believe it adds to the safety and security of my classroom.

Students often enter our classrooms with their alarm buttons on. It is our first priority to teach all our students. If the stress response is in motion, they will not have the opportunity to learn. To give them an opportunity to put their thoughts and problems on the back burner, we do the following: Any day that I feel it is necessary, or if a student requests, we take a few minutes at the beginning of class and write down anything that is bothering us. The slip of paper is folded and stored in a box on my desk. In this symbolic way, their problems are no longer with them. When I first introduce the strategy, I tell them how sometimes, we have important things to attend to. Our attention is difficult to divide. If we put our problems on hold while we do our work, I make sure that later in the day, we have time to go back and look at what we have written. If the problem is still important, they may take the time to discuss it with someone in the classroom. What is interesting is that most of those problems are no longer problems later in the day. Many of them are small disagreements or concerns about virtually unimportant items. After giving the students time away from these interferences, they often realize that what they thought was a big deal no longer is one.

If the stress response is in
motion, they will not have
the opportunity to learn.

Giving students the opportunity to put their issues aside gives me the chance to halt the stress response and begin the learning response.

> Julie walked in one morning and requested the back burner activity. Students who were interested took slips of paper and wrote down their perceived problems. As my class wrote, I noticed that Julie occasionally looked over at Rachel. Then, Rachel looked at Julie and began writing with a mission. The class finished and placed their papers in the box. Considering the looks these two girls were giving each other, I was afraid the strategy would fail that day.
>
> I walked over to the box and placed my hand on it and said, "I am afraid my box isn't strong enough to hold today's issues. Some of these problems need to be taken care of right now. Does anyone feel the tension I am feeling?" Every eighth-grade girl raised her hand. The boys looked around as if we were all crazy. "Let's take a few minutes now and deal with these." The girls gathered together around Rachel and Julie as they worked out their problem. Rachel's boyfriend had called Julie and hadn't told Rachel. It was quickly resolved, with the blame being put on the boy. Peace came over the classroom. We continued our lesson.

At times like this, a change in plan is necessary. I knew I would get nowhere with the lesson I had planned, with all the tension in the room. Because of the safe environment I had created and the rituals that were in place, I was able to give the students the chance to work things out, without the threat of losing total control of the class. There will be times when alarm buttons are on and nothing I do will switch them off. At least with these strategies, I have a chance to tame those lions.

Wizdom

- Just as mimicking is the way students learn empathy, it is also the way they learn to be sarcastic or to tease. Teach your students to be good role models for others.

- Creating a safe environment is our #1 job. Our classes are more diverse than ever. Look at your students carefully and try to determine what will make them feel safe.
- Keep in mind that ritual is more than a routine. Taking attendance every day by calling students' names and waiting for a reply is boring and time-consuming. Unless you are making a connection through this procedure that engages the class, you are probably offering students time to become bored and misbehave. Make your ritual relevant and timely.

4

If I Only Had a Heart: Emotional Growth

You people with hearts have something to guide you and need never do wrong; but I have no heart, and so I must be very careful.

—The Tin Woodsman

I am at a book-group meeting. We are discussing Daniel Goleman's (1995) book, *Emotional Intelligence*. This particular group consists of educators, and most of us are also mothers. The discussion is almost argumentative, although we soon discover that we are not arguing with each other. We are simply expressing our concern that this book has hit on the key to our problems in education. Students must have these emotional-intelligence skills to attain any cognitive skills. What can we do about it? Should there be a separate curriculum? How can we fit it into our overflowing days? How do we incorporate all of these necessary skills into our day-to-to day work? Will we be "picking on" a child who exhibits poor emotional skills when we point it out? Is this really our job?

Before the brain is cognitively aware of what information it receives, it is *emotionally aware!* according to Goleman (1998a). In his book, *The Emotional Brain* (1996), Joseph LeDoux explains that especially in the case of fear, the body reacts before the brain is aware of what it is afraid of. For instance, until we are already running from the bee buzzing around our heads, we don't realize why we are running. What does this mean to us in the classroom? I walk into my literature classroom and say "Today, students, we are going to study one of the props we will be using in the play we will be reading and discussing." I certainly have their attention as they wait to view this prop and wonder which play we will be reading. Some may simply be worrying about which parts they will get in the play. "My intention is to get you familiar and comfortable with the prop because the entire plot depends on the journey this prop takes throughout the country. We need to understand how this item works, what it is made of, and how it is made." At this point, I reveal the prop—a perfect replica of a rifle. Before many of the students even absorb the idea of a rifle, they react emotionally. I hear gasps, see children physically withdrawing from the object, and hear comments such as "Cool!" The students I have just frightened may be lost to my words for the rest of the period, or it may take them several minutes to realize that I might be giving them other important information. Therefore I may be wasting some time trying to teach them.

I am sharing this to illustrate the power that emotions have over us. Managing emotions is one of the five key elements discussed by Goleman (1995) in his book:

- Self-awareness
- Managing emotions
- Self-motivation
- Recognizing the emotions of others
- Handling relationships

Although these may seem like very tall orders for many of our students, we hope—and it is likely—that most of them will enter school with these skills. What may have happened at home to develop them is worth looking at because we are often expected to duplicate conditions that encourage the practice of these skills. The period from cradle to school ranges from 2 to 5 years for our students. Yet the opportunity for emotional intelligence begins in the cradle.

Heartbreak: The Lack of Social and Emotional Stimulation

We know from the horrifying Romanian orphan situations that social and emotional growth are not possible without human contact. The positron emission tomography (PET) scans of those orphans showed huge vacant areas in their brains when compared with children who had been raised with affection, conversation, and love (McCormick Tribune Foundation, 1997). The theory behind raising the orphans in Romania without attachments made sense to the caregivers. Because the turnover in help was so high, they were afraid that the children would become attached to someone only to lose them shortly thereafter. The trauma of constant separations appeared to be more harmful than the emotional neglect the children experienced (McCormick Tribune Foundation, 1997). The behavior of the children varied from continual rocking and mumbling to some aggression. With love and attention, many of these children are now leading normal lives (Fischer, 1999). A small percentage still have emotional and behavioral problems, and they may have them the rest of their lives.

Experiments done in the 1950s with monkeys revealed the same types of reactions. Baby monkeys who had been isolated for several months and were then placed back into "society" exhibited strange behaviors. The monkeys showed cognitive deficits, as well as immune deficiencies. The immune problems may well have been from the stress these monkeys experienced through their isolation. The serotonin levels of these babies were abnormal; for some, this caused aggressiveness and for others, acquiescence. They also had trouble mating, and many abused their own babies (Barnet & Barnet, 1998). These are extreme cases. All mammals have a basic need for mothering, and they all fear abandonment. Indeed, a separation period of a mere 24 hours can cause physical changes in an infant such as blood pressure, responsiveness, and heart rate (Ramey & Ramey, 1999).

Many kinds of violence can cause harm to a child's brain and affect emotional and social abilities. A single incident has the power to alter the brain's chemistry and arouse fear and suspicion that could lead to depression or drug abuse. Because of the brain's plasticity, much can be overcome. In cases of consistent abuse and neglect, children are constantly hypervigilant, looking for danger in every face and around every corner. They may be scanning their teachers' faces for threat or punishment, with hearts racing and cortisol levels

high. An innocent nudge or bump on the playground may be misinterpreted and lead to inappropriate reactions (Brownlee, 1996).

Creating Heart: A Look at Emotional Intelligence

What should normally occur to provide children with normal brain chemistries and appropriate social development? At this point, we are going to look at a healthy child, let's say a little girl, in a healthy environment. We will assume that nothing interfered with the migration of neurons and that the child was born with normal birth weight and has a caretaker with whom to bond.

The first important point is that the child has someone to respond to her needs. At this very early stage, the infant learns that her needs are important. Thus she becomes aware of her *self.* She becomes hungry and cries, and her mother comes to feed her. This affirmation is the beginning of an understanding of her value. Along with this knowledge comes the assumption that the world is a very safe place. In other words, the baby can predict on a regular basis what is going to happen in her world. She understands that her feelings are important and will be addressed.

The atmosphere of this early care appears to affect the brain structure, the amygdala. This area of the brain is related to emotions. We saw how sensitive this structure can be to stress, and the early phases of a child's life can have a great effect in this way. The amygdala receives highly sensitive information from many brain areas. In turn, it calls on the structures that affect bodily functions, such as heart rate (Brothers, 1997). It is very important that the early sensory information be soothing and reassuring.

Babies can also learn to *manage their emotions* in the crib. Initially, whenever the infant is upset, a caregiver promptly arrives and calms the child. When her world is safe and secure, she eventually begins to calm herself. This is the first opportunity for her to manage her emotions. As the child leaves the crib and continues a safe relationship with the primary people in her life, her self-awareness and handling of emotions continue; however, the adults in her life must model the appropriate behavior. In other words, her role models also act as emotional coaches and help the infant and young child work through her emotions.

The result of responsive, supportive feedback offers the child a confident outlook and encourages exploration and learning (Ramey & Ramey, 1999). In

this way, the *self-motivation* area of emotional intelligence naturally emerges. As understanding responses are received, the child ventures out to discover more of the world. The knowledge that someone is nearby and will react to her needs allows greater motivation to explore and conquer new areas.

We must look at impulse control in the area of self-motivation. This skill is imperative in the successful child. If one can control one's impulses, one is less likely to behave in a manner that concludes with inappropriate results. Impulse control can be learned. Goleman (1995) refers to the "marshmallow experiments" of the 1960s. Stanford University did a study of 4-year-old preschoolers. These children were each offered a marshmallow and told that the experimenter had to leave the room. If they waited to eat the marshmallow until the experimenter returned, they would receive two marshmallows. Waiting was an impossible task for some of the children, and some did wait a seemingly very long time and managed to get the second treat.

What was amazing about this simple test was its later consequences. As these children were tracked up to 14 years later, it was discovered that those who had resisted impulse and delayed gratification handled life more easily. They appeared to be less stressed, dealt with pressure more easily than the group who could not wait for the experimenter, and had higher scores on their scholastic achievement tests (SATs). Good impulse control at an early age is a strong predictor of later success. What is especially comforting to us as teachers is that delay of gratification and impulse control can be learned. Students may come to school possessing these skills because their parents simply insisted that all their vegetables be eaten before dessert or that their rooms be cleaned before they watched television.

Recognizing the emotions of others is an empathic act that actually begins prior to the infant realizing that there are *others*. Studies have shown that babies in cribs will cry when they see or hear the cries of others. At 2 or 3 years of age, the babies are still not sure that the pain or discomfort of others is not their own. Even at the toddling age, one may see empathy in the young child who tries to comfort another who is crying. Some will offer the upset child a blanket or toy. The comfort that he or she received enables the individual to offer empathy to others. Children who have not been responded to and acknowledged in a positive fashion may approach other crying children and yell at them to stop or perhaps slap them. This is indicative of the kind of responsiveness children have received.

According to Hoffman (Barnet & Barnet, 1998), there are 4 stages in the development of empathy. In Stage 1, the infant becomes distressed at the cries of another. Stage 2 is egocentric. At this point, children imitate the distress of others. Stage 3, which seems to occur around the ages of 2 or 3, is exhibited by

the knowledge that the distress is not their own and by trying to comfort others. During the school years, at around age 8, the final stage of empathy develops. This stage is more global in form. The child can use his or her imagination to help understand the pleasure or pain another is feeling. Different experiences have helped shaped the child's responses to the emotions of others, and he or she can begin to feel empathic toward large groups of people, such as those surviving disasters or disease.

The ability of children to be empathic comes from mimicking what they have seen modeled by the adults around them. When a caregiver recognizes a child's emotion and responds in a way that lets the child know the emotion is understood, empathy is being modeled and may develop. This type of interaction may include signals, eye contact, or dialogue. Empathic behavior is an important component of emotional and social intelligence that is lacking in many career criminals. They have no idea how someone else might feel. Therefore, hurting others does not seem to make them remorseful in any way (Goleman, 1995).

Again, the brain structure that appears to deal with empathy is the amygdala. This area responds to different facial expressions. The more activity found in the amygdala when subjects are shown specific expressions, the more socially sensitive the subjects seem to be. Damage in this area, parts of the temporal lobe, or in the frontal lobe may cause an individual to be incapable of judging the feelings of others and result in an inability to make social connections.

Handling relationships is an emotional and social skill that can easily result from acquiring the preceding intelligence skills. If an individual is aware of his or her emotions, manages them, is self-motivated, and can show empathy for others, it makes sense that the individual will get along with other people. However, this is a learned skill that can easily be overlooked in the preschool years. This skill falls under Howard Gardner's definition of interpersonal intelligence. It includes organizing groups and influencing them, as well as the ability to analyze situations and gain rapport with individuals in various situations (Gardner, 1985).

The interaction between child and caretaker is the beginning of this skill. It may be reinforced and enhanced through play groups, family interactions, and preschool. Through practice, play, and modeling adults, children learn to persuade, influence, inspire, and create intimate relationships—skills that can take them far in life.

Heart-to-Heart

Benny and Aaron have been friends for as long as either of them can remember. They grew up in the same neighborhood, their mothers shopped at the same corner grocery, and they know all the kids on the block. Today, they are walking to school together the way they have since kindergarten. They talk about their favorite teachers and fool around until they are on the playground with the other children. Benny wants to swing, and Aaron follows slowly over to the swing set, where several children are playing.

Benny yells, "Hey, you guys, it's our turn now. Somebody get off."

Most of the children are too busy to pay any attention to Benny, and those that notice him continue to swing.

"I said you should get off the swing now. You've had it long enough. I want to swing." There is still no response. Benny walks over to a small boy on the swing and grabs the rope. This action causes a jerky movement and the swing stops suddenly. The boy almost falls off but manages to keep his balance. The child begins to cry as Benny continues ranting about his turn.

By this time, Aaron has arrived at the messy scene. He knows the small boy on the swing, whose name is Will. "Whatsa matter, Willy?" asks Aaron.

Benny blurts out, "He won't get off the swing and it's my turn!"

Aaron puts his arm around Willy and looks at Benny. "We just got here, Benny. We haven't waited for our turn yet. Let's go down the slide while Willy finishes swinging. Then maybe we can have his swing."

Willy nods his head and wipes his tears with his sleeve. Aaron takes Benny's arm and guides him toward the slide. Benny turns around, glares at Willy, and shouts, "You better be done soon, that's all I can say!"

Two boys from the same neighborhood are trying to get along in this world of the school. One chooses tact and negotiation; the other chooses to be pushy and powerful. We know who will be more successful if from this point there is no further emotional and social growth. Can school affect these positive changes?

Straight From the Heart: Social and Emotional Growth Strategies

As the Tin Woodsman went on Dorothy's journey, he was provided with opportunities to use the heart he thought was missing. Situations allowed him to use the emotional intelligence he already had and to develop it while he was on the road. Children need those same opportunities. Becoming an emotionally intelligent person can be taught, and I found that incorporating it into the classroom was more natural for me and for my students.

There are eight things I keep in mind as I set up my classroom and the atmosphere in it. They are in no particular order of importance. In fact, I find that the more spontaneous I am while embracing these skills and opportunities, the more potent they become.

- Pretend play/role play
- "Mind Reading"
- Teaming/grouping
- Delaying gratification
- Choices
- Rapport skills
- Journaling
- Physical outlets

Pretend Play/Role Play

Because the brain is so underdeveloped at birth, we as a society must commit ourselves to the 20 or so years it takes for full development. For our children to become acting members of the civilization in which they live, they need practice. If that sounds funny, think about what childhood and adolescence really are—a time to figure out where to fit in and how.

Every society has rules and regulations, and children must learn them. This is a gradual process acquired through their environments. To practice these rules, children use play (Brothers, 1997). In their play, they become others, often adults, who are either following the established rules or disobeying

them. In other words, they are "trying on" different roles and finding which ones suit them.

Pretending is encouraged in many environments while children are very young, but in school, little time is made for this activity. The costume and dress-up corners often seen at preschools and in some kindergartens are usually gone by the primary grades. These opportunities are very important in the context of social and emotional growth. Children take the mental scripts—from their personal experiences or those they have viewed on television or read in books—and share them with other children. As the children share these social scenes, interaction takes place in which each child involved has the opportunity to change. They may agree with the interactions of others, disagree and explain, or possibly ask an adult or other child to settle a dispute about the way things are "supposed" to happen. *Social rules are learned and reinforced.*

In the eyes of older children, the idea of "pretending" is too immature. This is where *role play* allows for the same social rules to emerge. Regardless of what the content of the class might be, there are opportunities to use role play as a valid activity to reinforce learning. In social studies, groups could role-play a scene taking place in a Southern home during the Civil War. Discussion of feelings and events may follow. A reenactment of the Boston Tea Party has been done successfully, with observable changes in attitude and behavior by the actors after having put themselves in someone else's shoes. Literature is easily conducive to this activity, as is a writing class. Math calls for role-playing in making change, measurements, and discussing geometric figures and algebraic equations. Clever science teachers have even used role-playing in the form of students becoming elements of the periodic table and discussing the possible outcomes of "becoming involved with each other."

We have little time for play in school because of the pressures of preparing students for standardized testing and our need to "cover the curriculum." However, we must remember those "marshmallow kids" who scored higher on their SATs, seemingly because their emotional intelligence was high.

"Mind Reading"

This is a game I made up. It needn't be called Mind Reading, but it actually is fun and beneficial for many of our students. Many studies have suggested that some people have difficulty reading faces. That is, they are not able to accurately relate the expression on another's face to the actual emotion being

experienced by the person. Many scientists believe that facial expressions are actions of inner feelings. They are a form of social communication (Brothers, 1997). Therefore, it becomes important that children be able to read faces and respond appropriately.

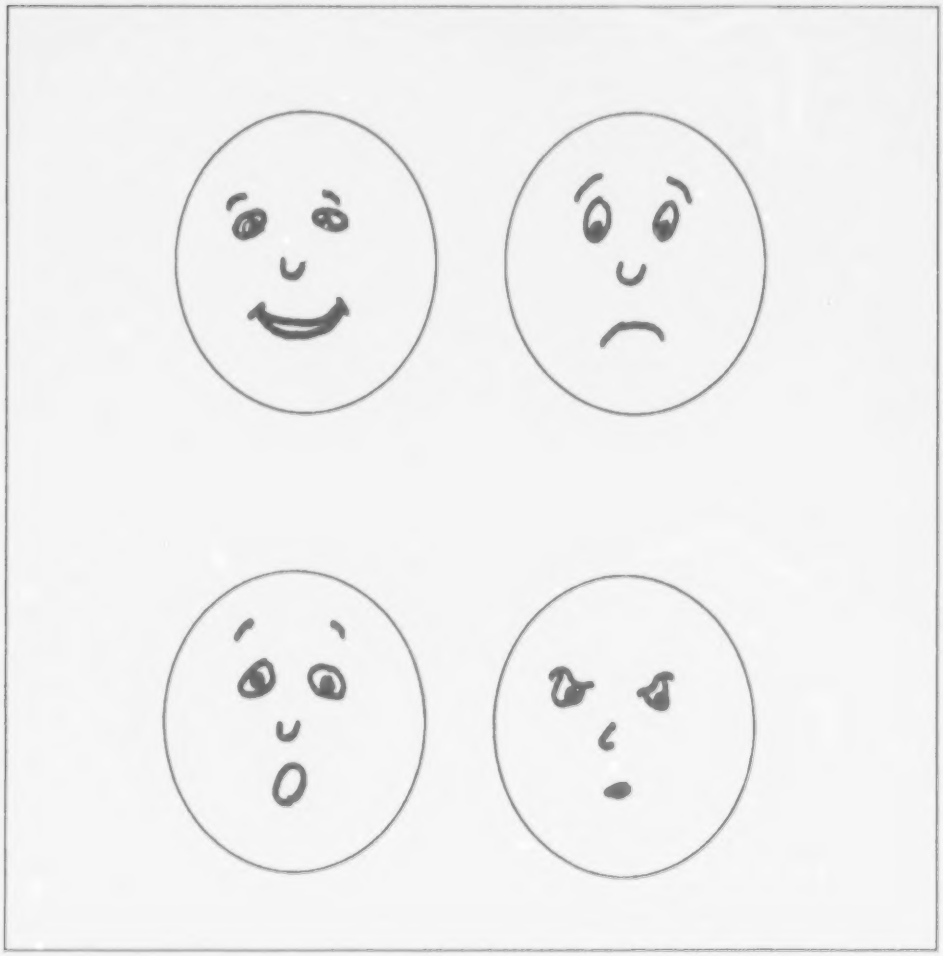
We know from current research that emotions drive attention and attention drives learning (Sylwester, 2000). Students who don't read expressions well may get messages confused. This can cause emotional turmoil that will keep their attention away from the task at hand. We must do what we can to help students separate emotions. A study was done of girls in 7th through 10th grades. Results indicated that eating disorders among these girls were affected by the fact that they had difficulty identifying one feeling from another (Goleman, 1995). Some people cannot tell the difference between feeling angry, hungry, or afraid. They combine these feelings into one and try to eat their way out of the emotion. I found that using some funny faces made it easier for my students to sort out their own feelings.

From culture to culture, people seem to recognize and read six basic expressions: fear, anger, sadness, disgust, happiness, and surprise. The ability to read these expressions may be based on survival. As a species or as a culture, it may have been imperative that we were able to assess strangers as enemies or friends simply by reading their facial expressions. Unfortunately, not all children are able to read faces. In my years of training teachers in brain-compatible strategies, I have been amazed at how many teachers have shown concern for the number of children misreading social cues, including facial expression. Some studies done at the University of Wisconsin have shown that abused children not only overreact to pictures of angry faces but also misread other expressions as anger (Blum, 1998). These children may need to be ready for anger at home, but becoming defensive or fearful at school when misreading the expressions of others may lead to real trouble.

From culture to culture, people seem to recognize and read six basic expressions: fear, anger, sadness, disgust, happiness, and surprise.

So, Mind Reading became my game. It begins with a poster showing different facial expressions. I hang it on my door so the students see it as they enter and exit. After a few weeks, I ask the classes if anyone has noticed the

Figure 4.1. Drawings Used in the Mind Reading Game
NOTE: Students have to guess what the facial expression represents.



poster. I have heard several comments made in their passing by then, so I know I will get some acknowledgment. We start discussing the various expressions and what they mean. This is something I do when I have a few minutes to spare.

Then, I draw some pictures of my own (see Figure 4.1). My artwork leaves a lot to be desired, but amazingly, I get the desired point across. I put four faces on an overhead or make handouts. They do not have the expression in writing

beneath each face as the poster does. I have the students do some Mind Reading as to what the person is feeling. The six basic expressions are the ones I start with and mix up. Then, I begin adding some of the other expressions from the poster. These are a little more difficult to discern, but the kids have a great time trying to figure them out. Along with the recognition of the expression, we add stories explaining why the person feels that way. We practice making the same faces ourselves. This adds to the fun and gives the students the opportunity to see how the expressions of some people are a little different from others.

Next, I begin to hold up a face every day as they come in. I put an expressive look on my face and hold up the face that shows how I feel. The kids tell me how I feel and try to guess why. Eventually, everyone gets a stack of faces and as soon as everyone is seated, they each hold up a face. I have the option of asking them why they feel that way or let them find a partner to do that. We become quite good at it, and the students become more emotionally involved with me and with each other, which leads to a more secure classroom.

This activity enables my students to become aware of their emotions, read the emotions of others, in some cases express empathy, and manage their own emotions. For the little time it takes, the activity helps them develop many of the emotional intelligences and is well worth it.

The value of reading the expressions of others can be shared at any grade level. In the upper grades, this type of activity may be taught as a skill that would be helpful in the job market. Getting and keeping one's job could be dependent on understanding how others are feeling and knowing how to deal with it. Using this type of strategy in a career class or unit may make the class more realistic and enable students to relate what they are learning to previous experiences. Mind Reading could also be integrated into social studies, science, or reading. (How was the character feeling? What did he look like when he felt that way?)

There are other great ideas for developing self-awareness that you may find more interesting. Goleman (1995) mentions a strategy that deals with attendance. As the student's name is called, the student says "Here" and adds a number from 1 to 10. The number 1 means that the student is happy, and 10 indicates that the student is not having a great day. The numbers in between indicate varying levels of happiness. The students may give reasons for the number if they choose. There are variations of this strategy, which has worked very well when I have used it.

Another clever idea is to read Dr. Seuss's *My Many Colored Days* to the students. Let me assure you that students of every age can appreciate this book. There is also a video available of the book, which may be a preferable option

for you. After understanding what feeling each color represents, you can have colored strips of paper or cards at the door as the students enter. Each student picks a card to indicate how he or she is feeling. This may be used as a cue for you, or it may be used as a discussion. Whatever strategy you choose, you will be honoring each student's feelings, which will further your personal relationships with your students.

Teaming/Grouping

Just as Dorothy needed her "team" of the Cowardly Lion, the Scarecrow, and the Tin Woodsman, your students also need a feeling of belonging. I cannot say enough about the importance of this strategy. I began using it in 1992 on a regular basis. Teaming can solve a number of problems. Putting your students on teams can make teaching and learning more fun. It makes taking attendance easier. It enables students to give each other positive feedback that may increase their serotonin levels, which may make them calmer and happier. It gives students a feeling of belonging, which is one of the basic needs. It enables students to *learn and practice* the emotional and social skills that are necessary for success in school and in life.

Teams don't just "happen." Students need to know what the expectations of the team are. Discussing possible team problems and role-playing some of those may be necessary if your students have not experienced this type of learning situation. There are steps in team building to aid the feeling of belonging. As a primary human motivation, belonging is essential. Humans try to belong by imitation, contagion, or identification (Brothers, 1997). Contagion can be positive, as in being part of a cheering crowd at a football game, but in general, it is less productive than the other two forms. Imitation is how children first learn. Mothers tend to imitate babies, who then imitate back. As babies and small children begin to imitate adults, it is gratifying and affords some special bonding (Gopnik, Meltzoff, & Kuhl, 1999). This is the basis of wanting to belong. Identification may be the most common and possibly the most positive way of belonging as children get older. For some children, identifying with a group or team may only occur in a classroom.

The methods of putting teams together are numerous. The only one I object to is letting students choose their own teams. Most of us have been in that humiliating situation when we were picked last or—what could be worse?—no one wanted us! Assemble the teams yourself, or if you wish, you may put them together randomly. This team is for identification, not for a specific project. It gives the students a group to be with as they enter the room.

When I take attendance, I say, "If you have 100% of your team members seated and ready to go, raise your hand and say 'Yes!'" They have to check and make sure that their teammates are present. It gives kids a good feeling to know that people are going to notice if they aren't there. This team might help each other with homework, remind each other of upcoming assignments, and keep each other on task.

Teams promote social skills. Getting along with different types of people is essential in this world of team-oriented business. Follow some simple steps to give your teams an identity.

Teams promote social skills.
Getting along with different types of people
is essential in this world.

1. *Give the teams some questions to answer as a "get to know each other activity."* We sometimes assume that kids have gone to school together long enough to know each other, but some questions can rouse some interesting conversation and bits of information they didn't know before. Use questions such as "Who are three people you would like to have over for dinner tonight?" Or "Who would you like to see walk in the door right now?" Or "If you could be anywhere else right now, where would you be?"

2. *Have the teams pick a team name.* They are used to identifying sports teams with names, so this may be fun. Make sure they keep the names positive, and if you like, they may be associated with a specific topic.

3. *How about some team colors? Or a team handshake? Or a team logo?* Talking about these will bring the group together and help make them a team.

4. *Have your teams make up a cheer or pick a theme song.* This helps with the identification process, can be loads of fun, and you can have them use the cheer or song to notify you when their team has completed an assignment or project.

5. *Team goals may be appropriate now.* What do these team members have in common as goals? Will they help each other reach them? Are they

TABLE 4.2 Team Chart Sample

Mrs. Sprenger's Team Chart, 3rd Period	Cooperation	Participation	Punctuality	Homework	Average
The Dendrites	5	7	10	8	7.2
The Brainiacs	7	9	9	8	8.2
The Dreamers	6	7	10	9	8
The Thinkers	9	10	9	10	9.2

attainable? When? Many teams need help setting limits and being specific with goals.

6. *Do you want a team scorecard or chart for self-assessment?* This could be a simple 8 1/2″ × 11″ sheet of paper or a larger piece of construction paper. They could assess themselves on punctuality, cooperation, participation, and homework completion (see Table 4.2). These are only examples. Be creative!

7. *If you want team leaders, rather than have students vote for one, let each person decide if he or she wants to be a leader.* Perhaps they can take turns. Give them your job description for team leader so they know what will be expected. If no team members are interested in the leadership position, you may choose a leader and try to work with that student to bring out leadership qualities. Try to choose a student who already has some good emotional-intelligence skills or someone who works well with others. You may be surprised at how well some students do in this capacity. Often, leadership skills are not expressed because students have not been in situations to use them. This may be a great opportunity to discuss world or local leaders and how they conduct themselves. Perhaps the students could pick one of these well-known and successful leaders to model themselves after.

Now you have a team! These kids have goals, criteria to assess themselves as good team members, a chance at leadership, a name for identification, and a cheer or song for fun! If this sounds like a lengthy process, it needn't be. Don't

allow much time for these steps. Show them that working together makes work go faster and easier.

Teams cannot stay together for long periods of time. As in any social situation, at some point, a hierarchy will develop and that means someone is going to end up at the bottom of the social structure. You don't want to leave them there for very long so change teams often enough to avoid this. Remember, this is a base team, and you can mix them up for other projects, activities, and subjects.

Delaying Gratification

Why not try your own "marshmallow test"? Depending on the level you teach, you wouldn't necessarily use marshmallows. This might be a good way to show your students what impulse control is all about. Discuss impulses and how difficult it can be to wait for things. Ask your students for examples of situations where they have difficulty being patient.

This is a good time to talk about their goals again. Achieving those goals may very well be related to impulse control. Talk about their personal goals that are unrelated to school. Are they saving for a new bike? A new computer game? How about eating healthier food and staying away from sweets? Explain how this skill can affect their lives as they make decisions to pursue careers. I use the example with my students of my master's degree. I had the opportunity to delay my first job and work on the degree, but I couldn't resist the money I would be making. As I look back on that decision, I wish I had worked toward the degree then, before I had children and other responsibilities that made it more difficult.

After your students have an understanding of the concept, help them delay gratification. Ask them to finish certain projects or assignments before they do something frivolous and fun. Talk to them about doing their homework after school before they turn on the computer or the television. Paying attention in class has a great deal to do with impulse control. Remind those who have difficulty that you are asking them to refrain from talking or drawing until you have finished the lesson.

Choices

This is one of the basic needs often mentioned by the experts. Students need to feel that they have some control in their lives. That also relates to

school, which is a large part of what they do each day. You do not lose any control by offering students choices in the types of projects they create, in the type of assessment you give them, or even in the topics you cover. Within limits, students can make these choices.

> Students need to feel that they have some control in their lives.

You can also bring in the opportunity to delay gratification with this technique. Tell your students that both fiction and nonfiction are required in the curriculum. Which would they like to cover first? Do they want what they consider to be the most fun first?—or would they like to save the best for last?

Rapport Skills

Here's something we all want to have, but we rarely think of teaching it to our students. I have enjoyed teaching the basics to my sixth, seventh, and eighth graders, and I believe that one can begin to learn these skills at any age.

Explain to them that having rapport with another person does not have to mean that they are friends with them. These skills just help you get along with everyone. I usually begin by talking to them about how they approach me when they want something. Does it make sense to ask me a question when I am talking to someone else? When I approach them and stand over them at their desk, are they comfortable? Would they be more comfortable if I were to sit in the desk beside them and speak to them on their level? Do they like it when their parents ask them to do something while their favorite television show is on?

To us, as educators, this all seems to be common sense. It's not. It's emotional and social intelligence. Below, I list some basic rapport skills. It's fun to have the kids practice these while they role-play and as a team activity.

Steps to Build Rapport

1. Listen to others carefully. Everyone wants to feel that their words and ideas are important. If necessary, repeat back to them what they said in your own words. Make sure you understand their meaning.

2. Match the other person physically. If Mom is sitting down, sit down beside her and speak on her level.
3. Match the other person's volume and tonality. If your friend is whispering, whisper back. (Unless you're in my class and not supposed to be talking at all!)
4. Seek the other person's opinion. We all like to think that our thoughts and feelings are important.
5. Try to find something to agree on. If your new teammate doesn't like sports, try shopping. Ask questions until you find a common ground.
6. Sit beside a person whom you must confront. Sitting across from them separates you. If you are next to them, they feel you're on their side.

Books on the subject include *Instant Rapport*, by Michael Brooks (1989). Faber and Mazlish (1995) share similar ideas in *How to Talk So Kids Can Learn*. There is also the old standby that is not used often enough, *How to Win Friends and Influence People*, by Dale Carnegie (1936). These are all listed in the Reference Section.

Journaling

This technique is an easy way for students to start recognizing their feelings. It can be helpful to give them just a few minutes at the beginning of class to write whatever they may be thinking about. This may also clear the air for some who enter class with emotional issues that would interfere with their learning. If their amygdalas are in charge of their brains, I know I will not be getting information into any of their memory lanes. Emotions must always be dealt with first (Sprenger, 1999). Sometimes, they may ask for ideas to get started. Journal suggestions may be found in books, but I like to afford older students the opportunity to just write.

This task may be easier for your more verbal students, but it is great practice in writing for all students. Decide from the beginning whether you are going to read their journals. Some years, I tell my students that I will read them only if there are entries they would like me to read. Other years, I have collected journals and written short notes back to students. They really enjoyed this technique, but when I have 160 to 200 students a day, it takes too much time. There have been especially tense days when my students spent more time writing than I spent teaching. For instance, after some of the school

shootings that have taken place in the past few years, it was necessary for many students to get their feelings out. Some could talk about it, but others needed to write. *Just 5 minutes of journaling can improve the makeup of the entire period.* This takes us back to the idea of control. Writing about an experience gives the student a feeling of control over the situation (Restak, 2000).

> Writing about an experience gives the student a feeling of control over the situation.

When I have the opportunity to read my students' journals, I have learned much more about them than I would have without those remarks. I have discovered who has special interests, such as stamp collecting and astronomy. Some of those topics don't readily come up during the day. It has given me an opportunity to speak to students about things that are important to them, and I have sometimes been able to bring up the topics in class discussions in case they want to share their interests.

Physical Outlets

As stated in Chapter 1, having physical outlets is an important and basic need. Your classroom need not become a racetrack or a wrestling mat for healthy movement to take place. Exercise reduces stress, causes the neurotransmitters that enhance learning to be produced, increases our heart and pulmonary functions, and can be a lot of fun!

What kind of physical outlets are possible in your classroom?

Math. When children are learning measurement, instead of measuring small objects that fit on the desk, expand the range to include large objects so that children have to get up and move while measuring. How tall is the chalkboard? What is its area? How many feet (your own) does it take to get from your desk to the door? Horses are measured by hands—how many hands high is the file cabinet?

How about going outside for math? Finding geometric shapes outdoors can be fun and energizing for your students. A lot of emotions can be shared on these "field trips." Children can travel with their teams or partners and learn to cooperate as they do the assignment.

Science. Lab work is physical, but it usually employs only small motor movement. Larger movement is what you are after. Using the outdoors is great in nice weather. Leaf collecting, bug collecting, identifying clouds and drawing them, picking up rocks, identifying types of trees, and discussing ecology can be done outside. Inside? A science teacher in my building sent her students through the building to identify transparent, translucent, and opaque glass. They were up, moving, and learning. Bones and body parts can be labeled and identified using students themselves as the models. This promotes movement, learning, and fun.

Are you talking about weather? Become the weather. If you were a hurricane, how would you move? A tornado? A calm breeze? What does rain sound like? Make that noise with your body. What about a thunderstorm?

Social Studies. Reenactments are good for physical outlets. Divide the room in half into North and South for the Civil War. Act out a battle, a court case, or a presidential debate and put on costumes. This will enhance memory for the events in addition to providing movement.

Even I got bored when I taught geography and we covered latitude and longitude. But when the students lay on the ground representing the lines, the class and the concept came to life. Someone always asked, "Can I be the prime meridian today?"

Literature. Role-playing provides physical outlets for many children. There are numerous opportunities to role-play scenes from stories and plays. Putting poetry into movement is more challenging and sometimes more fun. Having students create their own skits or plays affords plenty of movement as they prepare scenery and props, practice for the performance, and add music and dance to their creation.

Grammar and Writing. Until I discovered a method of grammar that allowed for oral recitation, jingles, and movement, I was quite low in the physical department in English class. I could get kids to stand up as parts of speech and have them scramble to make sentences. They enjoyed that, but I couldn't do that very often and keep it fresh.

Taking their writing and making a reader's theater from it works well. Many students can be involved in this type of production. "Charades" is another way to provide a physical outlet. Other word games are also physical and exciting.

What about simply adding movement to your classes on a daily basis? You can call it exercise or stretching. You can turn on the "Hokey Pokey" or the

"Chicken Dance" and promote movement that way. The National Dance Association encourages us to include dance in our classes. Incorporating modern dance into academic presentations gives students the opportunity to work on spatial and kinesthetic skills (Mann, 1999).

We know that movement helps build a better brain. In her book, *Smart Moves,* Carla Hannaford (1995) provides wonderful information on the importance of movement as it pertains to learning. She includes many of the exercises and movements from *Brain Gym,* by Paul and Gail Dennison (1994). Many teachers feel that these exercises are the way to start each class period and believe it makes a huge difference in the atmosphere of their classrooms. I have never been disappointed when I have used movement as part of my teaching activities, and if I can't incorporate it into whatever I am teaching—there's always Chubby Checker's "Twist and Shout!"

Heartbeat

It is the end of the school year, and I have taken my third-hour literature class outside to write a poem about something they love in nature. Two of my students finish their assignments and come over to sit by me.

"What are we going to do without you next year, Mrs. Sprenger?"

"I'm sure you're both going to do well in eighth grade. I'll still be around to keep an eye on you."

"But you're the only teacher who talks to us like we're people. And you listen to what we have to say. Will anybody else do that with us?"

"I hope so, girls. I hope so."

Like the Tin Woodsman, your students want to have a heart. They also want someone to recognize and acknowledge that heart in them. Only in this way can their journey down the Yellow Brick Road lead them to the cognitive skills they need to feel successful and accomplished. The Tin Woodsman had a heart all along, as he finally learned when others acknowledged his feelings and he acknowledged them himself. Do that for your students, and make the journey fulfilling for all of you.

Wizdom

- Keep a close eye on the hierarchies of your teams. Try a technique such as a jigsaw[1] occasionally to make all team members important.
- Combining rapport skills with role play can be very effective.
- Your enthusiasm and encouragement can make many strategies successful. Emotions are contagious.

Note

1. To jigsaw, divide material into parts (chunks of information, sections, vocabulary words, etc.). Give each team member a different bit of information. Have members from each team who are assigned the same information work together to discuss and learn the new information until they become experts on it. Then, they return to their teams and teach the information to the team. Each member is an expert in a different area, and all areas are important. Every team member, therefore, is important (Fogarty, 1997).

5

If I Only Had a Brain: Complex Cognitive Skills

If you will come to me tomorrow morning, I will stuff your head with brains. I cannot tell you how to use them, however; you must find that out for yourself.

—The Wizard

A low humming emanates from my classroom. As I approach the door with a teacher from a nearby school, I pray that things are under control. After all, this teacher came to see a brain-compatible classroom in action. Did I say action? I mean, a brain-based classroom where children are getting beyond stress and using emotion to motivate them toward higher-order thinking. Yes, that's what I hope she sees when she enters my room. Not too much action—I don't want to see Trent throwing erasers and Jay tossing spit wads. This happened once when I left the room at the beginning of the year, and I still have nightmares about it.

We enter: I am tentative and hopeful; she is curious and perhaps a little skeptical. The humming is louder when we enter. I allow my guest to go first and I pause at the door to get a full view of the room. It

> is amazing! Howard Gardner would be proud! That hum represents the low buzz of seventh-grade voices as they work diligently on their projects. Most never realized that I had left the room, and others are still unaware of my return. Our ritual for greeting guests is to stand and applaud. (This either makes them feel welcome or keeps them from ever coming back. It also avoids feelings of being disrupted—we have a duty to perform, and we do it, as one of our rituals.)
>
> The state of flow abounds. The amount of teamwork and the quality of the projects mesmerize the visiting teacher as the students work in an almost pulsing fashion to stay synchronized. Some may call this synergy; others may call it flow. I just call it the way things should be when children's needs are met, the task is challenging, and the skills are in place. It is the optimal state of learning: I know what the problem is, I know there is an answer to the problem, and I have the tools to find that answer.
>
> The visiting teacher smiles and asks if she can walk around and ask questions. I encourage her to observe. I ask her to refrain from breaking the flow and, instead, wait for students to offer their expertise, She does. They do. Life is good.

Is this the way it is every day in my classroom? I would love to say yes, but it wouldn't be true. Does this happen more and more often as I become more aware of what it takes to have a brain-compatible atmosphere? Yes. How do I begin to get to this point? Just as you read in the preceding chapters, I have to work on "de-stressing" first and then on emotional intelligence. I cannot get my students using higher-order thinking and creativity until we have reached this point. The most important job I have is to manage my classroom in a manner that is conducive to higher levels of thought and creativity.

This all sounds pretty good, but what about children at different age levels? Where are they in their brain development? And if they are de-stressed and emotionally aware, what cognitive skills can they perform?

Cognitive Skills

Kindergarten, Grades 1 and 2

We must continually keep in mind that students in all grades are at varying levels of brain development. There are no absolutes, but a wide variety of

developmental skills can be addressed. From ages 4 to 7, the right cerebral hemisphere is developing more rapidly than the left. This means that most children are better kinesthetically. They are spontaneous, use a lot of emotion, and are usually quite good at imaging. From ages 7 to 9, we see more development in the left cerebral hemisphere. Now, language skills are better. Sentence structure and syntax are developing, as well as spelling skills. Students become more aware of the details, whereas earlier, they were seeing more of the "big picture" (Hannaford, 1995).

We must continually keep in mind that students in all grades are at varying levels of brain development.

So, at this level, we are definitely into concrete operations. These children do best with hands-on activities. Social interaction is just beginning. Students are still very *me* oriented. Because of a slight difference in the hemispheres between girls and boys, girls tend to have better verbal skills and boys seem to excel spatially. Fine motor skills are still a challenge to many students in these grades, but boys especially are displaying more gross movements.

Keep in mind that these children are still in need of adult guidance. Parents are still key players at home, and the teacher must become the surrogate.

Grades 3, 4, and 5

Students are still in concrete operations in these grades. There are signs of abstract thinking at basic levels. It is time to offer more options as far as learning and assessment are concerned. Some of these students will be capable of more in-depth research with some synthesis and analysis included. Others will still be very hands-on and will need opportunities to share their knowledge in more tactile ways.

At this stage, the quest for learning is strong. Children enjoy seeking out information and may want to act as reporters or interviewers. Peers are extremely important to students of this age, although the teacher has enormous influence over children. To use both strong adult and peer influence calls for working in large groups with the teacher as coach. At this time, students begin to empathize with large groups. Thus it is possible to use their

emotional intelligence to encourage research about issues that affect communities of people.

Grades 6, 7, and 8

Typically, we are dealing with the middle school child at this stage. These students are coordinating social relations, surging hormones, and a search for personal identity. During this time, students are concerned with the concept of fairness. In their minds, sameness and fairness must be identical, and this issue is sensitive and important to handle. Physical development is beginning to accelerate, and there are gross differences in development leading to even more delicate situations.

The brain is undergoing some enormous changes that may continue through the high school years. At puberty, a girl's hypothalamus begins to secrete chemicals to increase appetite. This is nature's way of preparing the body for childbirth by adding fat. In our society, however, this may be cause for alarm, and many girls become obsessed with their weight. The amygdalas in both boys and girls enlarge at this time due to the release of testosterone. This hormone is more prevalent in males. Their amygdalas become larger than the females, which may cause overemotional reactions. At the same time, the hippocampus, which we know is a strong memory pathway for factual information, grows from the release of estrogen. Estrogen is more prevalent in females, so they have larger hippocampi. To put the consequences of this simply, we have children beginning adolescence. The boys may be overemotional and overreactive due to the size and sensitivity of the emotional structure, the amygdala. The girls, who may have an easier time remembering factual information, could also be struggling with their body images as their appetites increase (Brownlee, 1999).

If that sounds difficult to handle, there happens to be more. The prefrontal cortex is the area of the cerebrum that controls the amygdala. It has not yet fully developed and may not do so until these students are in their 20s. Consequently, the brain structure that could help these young adults deal with their problems may not be physically able to do so. We may just have to accept the fact that these students may have difficulty making good choices. Our expectations of them may also be too high. They may not be able to handle the higher-order thinking that we assume they can.

That was the bad news. The good news is that the brain is plastic. It is also still growing and changing. It is not too late for positive transformations, and eventually, most of these students will have the physical ability to perform the operations that are expected of adults.

Let's take a closer look at that very specialized and important brain area, the prefrontal cortices. Why are they so important? Why do they affect so many skills, talents, and behaviors? There are two important functions of this brain area to consider. First, this structure acts as logical decision maker in the brain. As the amygdala creates an emotional attitude toward people and events, the prefrontal cortex shapes that attitude or stops it from being displayed. Without the prefrontal cortex, decision making relies heavily on a strictly emotional response. The other function of this area is working memory. For information to be processed—that is, either new information worked with and added to old information or old information spread out and reworked—there has to be space for this to occur. The prefrontal cortex is the working space for these processes.

> Sasha and Rochelle are studying for a final exam in Spanish. They are working at Sasha's house because her little brother is gone for the evening, and Rochelle's house is always crowded and noisy with all her siblings and their friends. The girls spread their books and notes out on Sasha's bed. Rochelle opens her text and begins to compare her notes and the chapter contents. Sasha goes to the radio and turns it on.
>
> "Could you please turn down that music?" Rochelle asks, with some frustration in her voice.
>
> "Oh, this is the song that was playing when Angelo and I were on our first date!" Sasha declares.
>
> "I don't care when it was playing—it ain't playing now!" Rochelle suddenly snaps the radio off.
>
> "What's the matter with you? This is my house, and I can listen to whatever I want! Besides, it will be over in a minute, and then we'll study!"
>
> "You can study by yourself!" With that, Rochelle grabs her books and storms out of the house.

In this case, Rochelle was reacting emotionally. She may have been stressed about the exam and then became further irritated by the music while she was trying to concentrate. She overreacted to the situation; it appeared that Sasha would turn off the radio right after the song. Rochelle was having trouble controlling her emotional response to the situation. Her prefrontal cortex was not able to monitor her amygdala's response to the circumstances.

> Nathan could not sit still. It was only one class period until art class, and he could not wait to get his hands on Michael. If Michael thought

for one minute that he could get away with saying that kind of stuff about his baby sister, well, boy, he was gonna get it. Nathan watched the clock as the minutes ticked by. He wanted to jump up and run out of English and go find Michael, but something wouldn't let him do it. He looked up at Mr. Sterling's algebra equation, but he had no clue as to what was going on. He tried to concentrate on what his teacher was explaining, but he couldn't stop thinking about those words Michael had said, "Nathan's little sister is easy—anybody can be with her!" Thinking those words took Nathan's breath away. He wiggled in his seat and tried to focus on the board again. Finally, the bell rang, and Nathan headed for the door.

"Oh, Nathan," Mr. Sterling called to him, "don't forget that assignment."

"Oh, yeah, sure!" Nathan yelled back. But he didn't know what Mr. Sterling was talking about.

Nathan was fortunate that his prefrontal cortex was able to control his emotions. As much as he wanted to act on his need to find Michael, he knew he should wait until his next class with him. Unfortunately, because the prefrontal cortex was so busy keeping his amygdala in check, Nathan had no space free for working memory. He couldn't take any of the information that was offered in his math class and work with it in his head. He didn't even realize that he had been given an assignment.

Like the Scarecrow who was looking for the brain he really already had, adolescents sometimes address the same issue. The brain is there, but the awareness is not.

Grades 9, 10, 11, and 12

Much of what was just described goes on through the high school level. There are some significant differences in the progress of this growth at all of the levels. Students in 9th grade are not as capable of abstract work as most 12th graders. At this stage of development, they begin to "hang out" in smaller groups. The physical body is rapidly maturing, and many of these students have the cerebral capabilities of planning for the future. They are still dealing with fluctuating hormones as the matter of sex becomes an issue. Estrogen and testosterone levels vary daily as well as seasonally.

Studies have compared teenagers with adults in various emotional situations. Using the brain-imaging technique, magnetic resonance imaging (MRI), researchers have discovered that most adults use their prefrontal

cortices to make decisions, whereas teenagers still rely heavily on their amygdalas (Yurgelen-Todd, 1998). The first knowledge of the importance of the frontal lobes came from a situation that occurred in 1848. A man named Phineas Gage was a foreman for a railroad company. Explosives were used to clear away boulders and debris to lay down track. Phineas had the responsibility of using a tamping rod (an iron rod, pointed at one end, about 3 feet long) to compress the explosives into a hole. As Phineas was tamping, the explosives went off accidentally. The explosion sent the iron rod through Phineas' left eye socket, through his frontal lobes, and out through the top of his head. The tamping rod landed 30 meters behind him. Amazingly, Phineas never lost consciousness. He got back on his feet by himself and was helped to a nearby doctor's office. After several weeks, Phineas was released by the doctor and sent home.

As amazing as his ability to recover had been, changes began to take place in Phineas. A well-liked, mild-mannered person suddenly turned into a rude and crude individual. He could not get along with others because he could not control his emotional outbursts. Phineas lost his job, his wife, and his family. He lived for another 13 years, at which time he began to have seizures and finally died. The medical community was astonished that Phineas still had many intellectual capacities, language, and memory. The extraordinary functions of the frontal lobes began to be examined after this incident. Researchers found that the remarkable area that controls impulsivity and emotional stability is the prefrontal cortex, the last area of the brain to fully develop (Shimamura, 2000).

Higher-order thinking may be expected of many teenagers and should be offered to all, but we must always keep in mind that development of this critical area will vary. Differing degrees of acceleration are possible, and students need choices in their study and assessments. Patience and understanding are key here because some students will have more difficulty than others using abstract reasoning and good decision making.

Promoting Cognitive Growth

The Scarecrow didn't know he had it all: courage, heart, and brains. Once children know that they are capable of learning, and their brains are ready to learn, the next step is for the teacher to decide what kind of approach to take to teach them. In my classroom, I work hard to keep three areas in mind as I create not only lessons but also an atmosphere for learning. I begin with

helping students understand how they learn best. I then create every unit of study while keeping in mind how memory works. If memory is our only evidence of learning, conscious effort must be put into creating those memories. Finally, I try to keep the multiple intelligences in mind as I create a classroom for learners with diverse gifts and resources.

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Understanding How to Learn

I was studying for my comprehensive exams for my master's degree. My friend had suggested that I take the questions the head of the department had given us to study and tape them and the answers on cassettes. This way, I could listen to them in the car on my way to school and back. It seemed to be a good idea. I made the first tape with the answer I had chosen and started my daily ritual of playing it. I was impressed with the amount of time I was putting into my "studying." It was a great way to get two things done at once, which immediately made me feel that I was putting my time to good use.

By the end of the week, I thought I was ready. I sat down at the computer with the first question; I was ready to type all that I had learned in the car. My hands were poised at the keyboard as I read the question over and over from the top of the screen. It suddenly dawned on me that I couldn't remember what I had recorded on that tape player. Angrily, I stood up and stomped out of the room. How dumb could I be? Had I really not been paying attention to that tape? Surely, 2 or 3 hours of listening should have placed something in my memory banks.

I threw those tapes away and began studying the way I had always studied. I looked up the questions (again) and wrote down the answers in my notebook. I read over those notes each night, underlining and highlighting the phrases I needed to remember. A week later, I sat at the computer again. This time my success was assured. I had done exactly what I had needed to do for the learner that I am. I had visual representations of the answers to those questions in my mind. I could

> even remember the page numbers and the places on the pages for some of my information. Obviously, the friendly advice I had received came from an auditory learner. She also did quite well on the comps—and had only listened to tapes.

Noted researchers Rita and Ken Dunn of St. John's University, in New York, have done extensive studies on the way people learn. They believe that there are three strong sensory channels for learning: visual, auditory, and kinesthetic (Rose & Nicholl, 1997). Although some refer to a learning modality as a preference, others refer to it as a strength (Guild & Garger, 1998). I believe it is a little of both. We use the networks of neurons that solve our problems for us in the easiest and fastest way. As we continue to use those same neurons, the connections become stronger. Therefore if an auditory learner gets positive results from listening and dialoguing, he or she will continue to do so as a preference, and that modality will be strengthened through use.

I have found in my classroom that determining a student's preferred modality is helpful. I also find it necessary to teach to all three modalities to reach all my students. In some cases, this can be challenging, but most of the time it takes very little planning to allow for all preferences.

Visual Learners

These students are happiest when they can see the information I am sharing. They absorb the world through words and pictures. They may not hear what you're saying, but they see what you mean!

It is not difficult to teach to visual learners because we have overhead projectors, chalk boards, textbooks, handouts, and posters to help convey the message. Some of these learners want to see me solve the problem to understand it, and others need to read about it for full comprehension. Visual learners may be offended when you read to them from the text or from the overhead; however, reading may help others with different modality preferences.

Visual memory has often been thought to be the strongest kind of memory, but we shall see later that rote memory may well be much stronger. To a visual learner, a picture may be worth a thousand words, or those thousand words may help this student create a beautiful picture of his or her own.

As a visual learner, I create scenes as I listen to music to help myself remember the words and the meaning. When music videos became popular, I was truly offended that someone else was trying to create my pictures for me. It took the personalization away from me, and I found it frustrating.

Visual learners often sit in the front of the classroom and often sit up very straight. They don't want to miss seeing anything. They also have a tendency to watch the teacher. It makes me feel very good to have students so entranced while I am teaching. In fact, in my early days of teaching, I found myself teaching to these students who seemed to be so interested. As I gained more experience and started using the modalities, I realized that this kind of student would stay with me without more visual acknowledgment—and that the other learners who were not looking might need my attention more.

Auditory Learners

Auditory learners learn by talking and listening. They enjoy having something read aloud to them or explained to them. Information isn't real to them until they have had a chance to discuss it. Looking at the teacher is not important to them, so I may find them looking out the window while I am speaking. This used to bother me a great deal because I thought they were daydreaming. Now I know that I just have to check in with them to be sure they are keeping up with the information—and they usually are. Those who have this modality preference would rather give you an oral book report, and you may not see much written down in a written report.

When these students read text, and sometimes they don't, you will often see them moving their lips or mumbling. In fact, these learners have a tendency to talk to themselves. If you are with them on a day when they haven't had much verbal intercourse, you may find their banter quite tiring. Of course, these auditory learners expect you to remember what they tell you even though they often have to repeat information to themselves several times to remember it. Dialects come easily to many auditory learners. They often do very well with foreign languages. Asking them to sit still and be quiet for long periods of time may be quite difficult. They may be extremely sound sensitive and easily disturbed by noises such as the radiator kicking on, others chewing gum, or the simple clicking of a pen. They usually enjoy music but may have their concentration interrupted by music they are unfamiliar with.

Auditory memory is sometimes stored in an unusual fashion, as though the information is on a cassette tape. These students have to rewind and fast-forward to find information that is not asked for in the order in which it was stored. Think of the alphabet. Most of us learned it to the tune of "Twinkle, Twinkle, Little Star." Those letters are stored in our cerebellum in order and to a rhythm. It is sometimes difficult to answer a question such as "What letter comes before H?" Often, one has to run through the song to get to that answer.

Auditory learners encounter that problem on a test when the questions are not in the same order in which the material was presented.

These listeners may turn their heads from side to side as they are trying to pick up sounds. They can sometimes be spotted tapping out beats on their knees or on their desks. They don't have to sit up straight like the visual learners because sight is not very important to them (Grinder, 1991).

Kinesthetic Learners

Kinesthetic learners have probably had the most difficulties in our traditional classrooms. Rows of chairs, sitting still, and being quiet do not allow these students' brains to become activated. One very bright student, Erin, is this type of learner and had many difficulties throughout elementary and high school. She is now a junior in college, and her parents and I are both grateful that she stuck with the system, as hard as it was for her. When writing my previous books and discussing modalities, I often asked Erin questions about her classes. How does it feel to be a kinesthetic learner in a visual and auditory world? "It's simple to explain to you," she said. "Walk into a totally dark room and try to read." I realized that I would not be able to learn anything under those conditions. What did Erin do in those "dark days" of traditional classrooms?

Kinesthetic learners need hands-on activities. They need movement. If they are reading a story, they hope for action and pay more attention to the action than to the description of scenery or characters. These students gesture a lot. To memorize, they often walk with the information in their hands. Erin walked back and forth in the back of my classroom. She never disturbed anyone, and it allowed her to pay attention. She was an excellent student.

Kinesthetic learners respond to physical closeness and physical rewards. They need a "pat on the back" rather than an "A" on a paper. You will notice that these students have larger physical reactions than others and they often use touch in communication. These students either wiggle and jiggle in their seats or slump down for comfort. The temperature of the room, the softness (or hardness) of the seats, and even the comfort of the clothes they wear are important.

Teaching to the Modalities

It is really not as difficult as some might think to teach to the modalities. Most teachers include at least two in every lesson. We usually have some sort

of visual, such as a handout, overhead, or textbook page. Most of us use discussion in every lesson, so that just leaves the kinesthetic component, which many of us forget or feel doesn't fit in. First of all, let's look at the basic fact that we all teach the way we want to learn. Because I am very visual, most of my lessons consist of visual stimuli. I love to read to my students, but my visual students would rather do it themselves (thank you very much!), and I need to offer them the opportunity to at least follow along in the book I am reading. Beware if you are an auditory teacher. The students soon discover your desire to talk and will have you on several different tangents, using valuable class time. Kinesthetic teachers would be much too hands-on for me, but they have a gift that means a great deal to the kinesthetic learner.

Here are some tips for teaching VAK (visual–auditory–kinesthetic):

1. Be sure to include each modality in your teaching.
2. Vary the modality you begin with. Some kinesthetic students will be lost until you get them up and moving—don't always save that for last.
3. Focus time for the brain on a good day is the student's age in minutes. That means 7-year-olds can pay attention for about 7 minutes. This is the perfect time to change your strategy from one modality to the next. You can stay on topic; just change the approach.
4. Remember that auditory learners need to talk as much as they need to listen. Provide these opportunities.
5. Kinesthetic learning does not require the student to perform an experiment or "become an adverb." It simply means that these students need to move. Provide movement activities as simple as changing seats, working on team projects, and stretching.
6. Learn to speak the language of the learner. Visuals often use words such as "I see what you mean" or "I get the picture." Auditory learners might say "I hear what you're saying" or "That sounds good." Kinesthetic learners use phrases such as "That grabs me" or "I can't get a handle on it." Try to key in on these phrases and use them when you speak to the student on an individual basis.
7. After presenting a lesson and assigning some seat work, observe which students need extra help. Perhaps there is a modality you are not giving enough attention to. For example, if most of the students coming up to your desk for help are auditory, you may need to stress the discussion part of the lesson next time.

Many students are great at getting information in all the modalities. So, the majority of your class will be fine with the way you are presently teaching. Those struggling few are the ones who may really benefit from some small changes. You are actually honoring the differences between students by trying to "speak their language." Information makes much more sense to them when it comes to them the way they prefer it. Affording the students the opportunity to discover their own learning modality may help them with homework and testing. This knowledge can go a long way.

Memory Lanes

On a daily basis, I let VAK learning guide me. When I am constructing a unit, I use the *memory lanes* as a guide. I have devoted a book to learning and memory and so will not be as detailed here, but I want to share with you the importance of finding the kind of brain the Scarecrow desires. Memory is not merely the only evidence we have of learning; it is also the only evidence we have of *self*. Without our memories, we have no identity. With them, we can be whoever we want to be.

> Memory is not merely the only evidence
> we have of learning; it is also the
> only evidence we have of *self*.

I have previously referred to working memory in relation to the prefrontal cortex. Again, this is a process by which the brain takes the old and the new information, checks to see if it fits together, decides if it is worth saving for the long term, or simply throws it away. Working memory is an important process and is vital to learning and comprehension.

Five memory pathways have been suggested by current research as the roads to success for our students. I can travel up and down Sheridan Road all day, but if you live on Main Street, I will never find you. So it is with memory. There are special lanes for specific types of memory. We need to know how to store memories in each lane and know how to retrieve memories from them.

Semantic Memory

This is the memory lane for words. Facts and lists we get from books are stored here. The semantic lane is found in the hippocampus. Important information in the form of facts must be cataloged through the hippocampus if it is to be held in long-term memory. Semantic information is the most difficult information to remember and retrieve. To be really successful at doing so could make you a champion at "Trivial Pursuit." The difficulty lies in the fact that the information has to go to working memory first. Working memory is a process in which information is held in the prefrontal cortex. Here, it is rehearsed, elaborated on, and worked with until it can be stored in long-term memory.

This information must be processed often for it to stick. This would mean discussing a few paragraphs of text material at a time. It could also mean outlining, mind mapping, role-playing— and repetition, repetition, repetition.

Because remembering semantic information is sometimes difficult, many people have created books full of semantic tricks. There are such mnemonic devices as acrostics, acronyms, peg systems, word pictures, and location systems. The best way to remember text information is to put it into another memory lane. As teachers, we do this all the time; however, we are not always cognizant of our strategies. For instance, I have been fortunate to become involved with an English grammar and writing curriculum called the *Shurley Method*. After teaching grammar for 12 years, I finally found material that worked, and there are reasons for its success. One reason is that the method uses many of the other memory lanes for storage. It provides jingles, rhythm, and a flow that promotes fast and easy learning. These strategies access memory lanes that make learning grammar easy.

Episodic Memory

The hippocampus also catalogs episodic memory. This is a kind of factual memory that deals only with location. In other words, when you learn something, you are in a specific location and that location can trigger the memory. People often ask, "Where were you when . . . JFK was assassinated? . . . Princess Diana was killed? . . . O. J. Simpson was chased?" Many of us (who are old enough) can associate a location with the details of the event.

Many studies have been performed that prove that people who learn information in a specific location will remember that information better in the same location.

> The family is preparing for a short vacation. I have just returned from work to finish packing and load the car. My mental list is flashing quickly through my mind: Put food in the cat's dish, mail the house payment, turn on the lights in the living room, and call my sister-in-law to remind her to bring in the mail. Everything except the phone call has been done. I leave my bedroom and head for the office to make the call. As I reach the door to the office, I pause and try to remember why I am there. What was it that I had intended to do? I turn around and go back to the bedroom. There, I remember that I had been going over the list. I repeat the list. The lightbulb goes on: I have to make that call. I hurry back to the office, grab the phone, and begin dialing.

Episodic memory saved me from that old feeling of craziness that happens when these *episodes* occur. The importance of this memory lane must not be ignored. Our students value this important opportunity to use memory triggers.

This memory lane is activated invisibly. That is to say, students picture information in places where it used to be. Staring at the blank chalkboard is one example. If information had been written there, they may recreate the visual representation in their minds and gather the material. Teachers are also covered with invisible information. At a recent presentation, a kindergarten teacher approached me with a great example. The students had been studying the water cycle. One morning, this teacher asked a particular student to tell her the steps in the cycle. He looked at her and explained that he couldn't do it. When she asked why, he said, "Because you don't have your red jumper on today!" She told him to close his eyes and picture her in the jumper and see if he could remember the steps. He did!

Creating different atmospheres in your classroom can enhance the episodic memory lane. Change bulletin boards for each unit. Use a different seating chart as well. Looking at the world from a new perspective helps make the information fresh and new. Wearing costumes and hats also helps. Although episodic details fade over time, they are excellent triggers for semantic memory information.

Procedural Memory

The procedural memory lane is located in the cerebellum. It is sometimes called *muscle memory* or *body-kinesthetic* memory. Driving a car and riding a bicycle are two good examples of procedural memories. How powerful is this

lane? Think about it—we never forget those procedures. So, how can we use this lane in the classroom?

Providing movement has become a brain-compatible teaching basic. We know from experts Hannaford (1995) and the Dennisons (1994) that movement enhances learning and memory and also strengthens neural connections. Every lesson should contain movement. Take that movement and repeat it often enough and it becomes a permanent memory. Along with that movement, the learning associated with it also becomes permanent.

In the case of brain damage or brain insults, it can become quite difficult to use and rely on semantic and working memory. For this reason, many individuals are taught to surround themselves with procedures to follow. These become natural to the body and enable tasks to be completed quickly and easily, without stress.

Role play, skits and other productions are avenues to the procedural memory lane. As students involve their bodies in the understanding of concepts and ideas, they form a new understanding of the material.

Keyboarding is a procedural memory after it has been learned completely. Asking a student to create work on the computer can be very difficult because the brain struggles between trying to be creative and trying to find the keys. It is very important to have students create with paper and pencil until they become so proficient on the keyboard that the struggle is gone.

Automatic Memory

Also located in the cerebellum, automatic memory is very powerful. It has been called conditioned-response memory because the automaticity is a result of conditioning. For instance, the information you have in this lane includes antonyms (I say "Stop"; you say "Go"). Multiplication tables, the alphabet, and decoding skills are also stored here. When you are reading a book and, at the end of the page, find yourself without a clue about the content, it is because you were using your decoding skills on the material but you were not using your working memory for comprehension. Perhaps you were thinking about what you were going to do later.

There are many ways to put information into this lane. Flash cards put information into automatic memory. Rhyme and rhythm are also great ways to do this. I have always used music to help my students remember difficult information. They choose a melody and sing the information. The military "count off" song worked very well for helping verbs. The students would march around the room and sing the words. This added a procedural memory to the learning as well.

Emotional Memory

This memory lane begins with the amygdala, the limbic structure that sifts through all incoming information for emotional content. The amygdala is very powerful and can take control of the brain. For this reason, attaching emotional memories to learning can make a tremendous difference in how material is remembered. The primary emotions are joy, fear, surprise, sadness, disgust, acceptance, anticipation, and anger (Margulies & Sylwester, 1998). Using these will help reinforce learning.

Surprise is one component of what is called *flashbulb memory.* This is the memory of intensely emotional events. For instance, the question "Where were you when JFK was assassinated?" may bring up a picture in your mind that is nearly photographic. This type of memory, although not accurate over time, is very strong. It has two components: emotional, due to the element of surprise, and episodic, because it takes you to a place. If we could make every learning experience for our students as memorable as some of our flashbulb memories, imagine the knowledge they would have!

Alternate Routes

I became a much better teacher when I began to consider the memory lanes for each unit I taught. It became a challenge to create some ideas for each lane, and it also was fun. The students became involved as well. By suggesting that constructing these memory makers would help them remember, the process worked even better.

Let's look at math. Story problems have always been a mystery to some children . . . and I was one of those children. All five memory lanes can help solve the problem.

1. Semantic: Here are the rules.
2. Episodic: Think back to other times and places where you have solved problems.
3. Procedural: The steps to solving problems are stored here.
4. Automatic: Basic math facts are in this lane.
5. Emotional: Good or bad, success or failure—these are stored here.

TABLE 5.1 Memory Lane Model: Making the Most of Your Material and Their Memories

SEMANTIC Textbook information; word by word	What mnemonic devices will be necessary for my students to understand this information? Which semantic strategies will be used? Will I need practice tests? How can I access other lanes?	
EPISODIC Location! Location! Location!	How will I decorate my room? Are there any accessories I can use? Are field trips possible? Where? When?	
AUTOMATIC Conditioned response	Will flash cards aid in remembering this material? Is there information that can be put to music to enhance automatic memory?	
PROCEDURAL Muscle memory/ Movement	What can my students "do" to enhance memory? In what ways can I get my students moving during this unit?	
EMOTIONAL Priority: Feelings and interest	How will I introduce the unit to access emotions? Is there any way I can put this information into story form? How will this information influence my students' lives? How do I feel about this information, and can I share these feelings?	

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NOTE: This model may be used to plan thematic units using the five memory lanes.

The more we practice accessing all five memory lanes, the easier it will become. As our students become successful, we will see the fruits of our labor. I have included the model that I use to guide my units (see Table 5.1).

- METACOGNITION

I divide the students into five teams. Each is given one of the memory lanes so that I have Semantic, Emotional, Procedural, Automatic, and Episodic teams. We are ready to do some problem-based learning. The question is, "Should drivers be allowed to use cell phones?" The students are excited about this topic and have some of their own stories to tell.

"My mom talks on the phone and puts on makeup when she drives me to school!" shouts one of the boys. "It's a wonder that I'm still alive. She scares me to death."

I tell the Semantic team to look for facts. Any statistics on accidents, deaths, number of cell phones in use, and so forth. They begin to brainstorm. The Emotional team is already gathering stories. One of the girls shares this information: "Some lady was on 'Oprah' the other day. Her daughter was killed because some guy looked down for a second to dial!" The Episodic team is charged with creating the atmosphere: bringing in pictures, posters, and news articles. They are also challenged to write their own story. The Procedural team's job is to check out any procedures, rules, or principles already employed relating to cell phone usage. They must also devise rules and techniques that meet their own safety requirements. The Automatic team is to plan a march on Washington. They must gather evidence for both sides of the issue, plan campaigns, prepare slogans, songs, and chants.

The room is buzzing as the children discuss, research, and plan. Some are busy on the Internet. Others are heading for the library to search current magazines and books.

The beauty of using the memory lanes for this learning, or any learning, is what the students discover about themselves. First, they must use higher-level thinking to gather and create memories for themselves and others. To find an access for any pathway, the students first have to grasp the information. They

must evaluate what parts of the information are valuable and worth remembering. Then, they must synthesize it to create the memory. This type of problem solving gives students the practice they need for developing complex cognitive skills. Students quickly discover which pathway works best for them. Thinking about thinking leads them to an understanding of how their minds work for information gathering, encoding, and retrieval.

The Eight Intelligences

To deal with the class I described at the beginning of this book and similar situations, I used the theory of multiple intelligences described by Howard Gardner in his 1985 book, *Frames of Mind*. After reading this book, I felt I had permission to try some nontraditional methods of teaching.

Prior to Gardner's work, it was thought that there were only two intelligences: logical/mathematical and verbal/linguistic. Only those two were included on intelligence tests. They were relatively easy to measure and satisfied this country for a long time. Through Project Zero at Harvard, seven intelligences were acknowledged (Gardner, 1985). In 1998, an eighth was added. Through the theory of multiple intelligences, the following are recognized:

Verbal/linguistic	Visual/spatial
Mathematical/logical	Interpersonal
Bodily/kinesthetic	Intrapersonal
Musical/rhythmic	Naturalist

Other possibilities are being discussed, such as humor, existentialist, and spiritual. At this time, they have not been expanded on. The eight intelligences are possible ways of expressing one's intelligence. Not all students are high in each area. Let's look at these areas.

1. *Verbal/linguistic:* These students think and express themselves with words. They are often good storytellers. This type of intelligence usually fosters a good vocabulary. You might find someone with this intelligence becoming a teacher or a talk show host.

2. *Logical/mathematical:* A logical thinker or problem solver describe this person. They have a tendency to use numbers easily, ask questions, and be quite precise. Bankers and stockbrokers fall into this category.

3. *Musical/rhythmic:* These students are somewhat sound sensitive. They not only enjoy music and rhythm but also are very aware of patterns. Humming, singing, and finding the beat with their fingers or feet are not unusual. Musicians, audiologists, and affiliation with the recording business may be the direction for these students.

4. *Visual/spatial:* You'll want your pilot to have this intelligence! These people create mental images and are aware of how objects look and move in space. They may draw, doodle, like puzzles, and work and create their own mazes. Architects and designers have this intelligence.

5. *Bodily/kinesthetic:* Here's one for Michael Jordan. This intelligence is exhibited by good motor skills and graceful body movements. Don't get tunnel vision here. Your surgeon needs to possess this intelligence, as well as dancers and athletes!

6. *Interpersonal:* This is one part of emotional intelligence. This person is sensitive to the feelings of others. He or she also interacts well with people, is good at sharing, and makes a great team member. Therapists, teachers, and talk show hosts are among the many occupations for this intelligence.

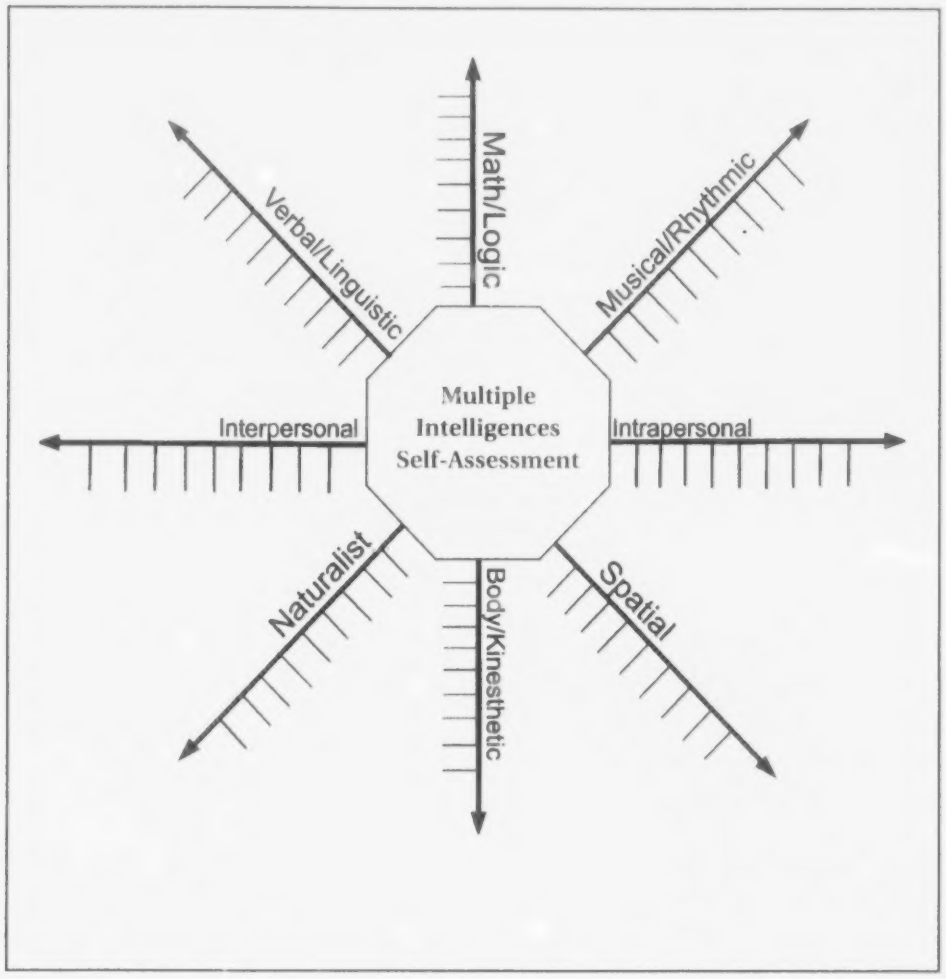
7. *Intrapersonal:* This is the other emotional intelligence. These are thinkers and observers. They understand their own emotions. Journaling is often a good activity for these individuals. Writers and philosophers exhibit this intelligence.

8. *Naturalist:* Another pattern seeker, the naturalist likes animals and plants. The great outdoors is where he or she wants to be. Classifying and categorizing come easily to this intelligence. Florists, naturalists, veterinarians, and outdoor recreation directors possess these skills.

Over the years, the question has been asked, "Do we teach *to* the intelligences, or do we teach *with* them?" Most multiple-intelligence schools work on themes or units that enable the intelligences to emerge. Remember that difficult class I was talking about? Here's what I did.

Shakespeare. Does it sound crazy? It worked. I took those kids down to the gymnasium. After finding some shortened versions of *Hamlet* and *Macbeth*, we started talking about who wanted to do what. My two most raucous boys wanted to be stars. (They quickly skimmed the plays and discovered sword

Figure 5.1. Multiple Intelligences Self-Assessment
NOTE: Students fill in as many spaces as they think represent their intelligence in each area.



fighting!) Some of the students were interested in props and scenery. Some wanted to come up with music for the scenes. They really became emotionally involved in the whole production. Everyone had to read the plays to understand what was to be done. We discussed the scenes together on the floor in the middle of the gym (except for the two sword fighters, who were off "practicing").

It was truly an incredible experience. It took 6 to 8 weeks to get everything done. By then, the students were ready for a performance. We had two, one during the day for the rest of the school and one in the evening for their parents. The students couldn't have been prouder, nor could their teacher.

I use a self-assessment with my students (see Figure 5.1). They enjoy filling in the chart and talking about what they enjoy because they "feel good" about it. From these assessments, I may form teams with as many different intelligences on them as possible. I find that the students work together better when they are not competing for the same tasks.

From the experience of using the multiple intelligences to teach Shakespeare to that difficult class, I continued my work on brain research, learning, and intelligence. Offering opportunities for students to explore and exhibit known talents, as well as explore and expand new skills and talents, is exciting and rewarding. Using the multiple intelligences is another way to do this.

"Can't you give me brains?" asked the Scarecrow.

"You don't need them. You are learning something every day.
A baby has brains, but it doesn't know much.
Experience is the only thing that brings knowledge. . . ."

Honoring our students' learning styles, memories, and intelligences will enable them to have experiences that are meaningful to them. From those experiences, they can gain the knowledge they will need to continue their journey and become lifelong learners.

Wizdom

- There are five modalities. Gustatory is taste, and although we have students who love to put things in their mouths, there is usually a stronger modality preference for learning. The olfactory sense, smell, is very powerful for learning and memory. It is difficult to use in the classroom because we have so many sensitive students.
- Information on learning styles provides a useful framework for understanding learners and identifying gaps in our teaching methods.

Rather than label students, use the knowledge to determine if your approach to subject matter offers choice and variety.

- Timed tests can cause stress. Stress can interfere with retrieval of memories. Our students don't have poor memories; they sometimes store information in different lanes. Many need time to search different lanes to access information. Understanding how and where we store information can add to self-confidence.

6

Which Witch Is Which? Calming and Controlling the Classroom

Come with me; and see that you mind everything I tell you, for if you do not, I will make an end of you. . . .

—The Wicked Witch

Blair approaches my desk after I finally found a moment to sit down. Sitting is something I have to remind myself to do. Today, it is easy to sit—I am in one of those moods. I don't want to speak to anyone. As Blair gets closer, she begins to ask a question.

"Don't even think about it!" I snap, in a tone of voice that means trouble.

The bell suddenly rings, and I dismiss the seventh graders. I go to the door to greet the next class, but my heart isn't in it.

"What's the matter?" the kind librarian inquires.

"I don't want to talk about it." The words come out of my mouth quickly and decisively.

Another teacher walks by and asks, "Are you going to the concert tonight?"

"I don't care if I ever go to a concert again! This place is driving me crazy!" With that, I turn around and stomp back into the room. Sorry kids, no greeting at the door today. I've had it!

I sit down again at my desk and pick up my pen. It is shaped in the form of a witch. A gift from a colleague, who had visited a Warner Studio store, it fit my mood perfectly. Yes, here I am, the Wicked Witch. But why?

From that time on, I would often let my students (as well as my own children) know that I was in a bad mood by saying, "The Wicked Witch of the West is here today." They knew that it probably wasn't a good time to approach me with any suggestions. What I didn't know was that my bad mood was actually a result of stress. Until I studied brain research, I had no idea how much stress influenced my behavior and how much my behavior affected my classroom.

If stress caused the behavior of the Cowardly Lion, how could stress also have caused the wicked behavior of the witch? The amount of stress we are able to handle varies with circumstances and with our body's ability to handle it. In Chapter 3, I discussed the stress response and how to "de-stress" students. What about teachers?

The term *allostasis* refers to the body's ability to adapt in stressful situations. For most of us, our body has had to deal with stress in an intermittent fashion. We have had small stresses; the body has responded and brought back homeostasis (balance). Chronic stress can give us an *allostatic load* that causes damage (McEwen, 1999). As our stress levels continually rise, we lose sight of that peaceful feeling and forget what real "stress-less-ness" is like.

Okay, so I am the Wicked Witch. So what? I can easily calm myself down. Maybe I just need to get away for awhile. That's it! I'll go visit Josh (my son) in Chicago this weekend. I won't take anything with me that even resembles education. No papers. No grade book. No plan book. It'll be great, and I'll return refreshed!

Easier said than done, right? I did go away without any of those items. I ate at nice restaurants. I shopped. Josh and I went to a play. I felt much better

Sunday evening when I got home. I was actually proud of myself for taking care of *me* for a change. And Monday morning . . .

> I stand at the door to greet my students. The sun is shining, and I am feeling great. The students enter the room. I walk over to the boom box to turn off the music. As I turn around to speak to the teams, Jay pushes Kent out of his seat. My metamorphosis occurs instantaneously. The Wicked Witch reveals herself again. "What do you think you're doing?" I shout, as though the entire city of Peoria needs to hear this. My tirade continues for several minutes as I lose control. When I finally feel I have gotten enough off my chest and have properly punished Jay (for that was what I was after—punishment, not discipline), I look around at my class. They are stunned. They are quiet and sitting up very straight. I have terrified them.

Power and control. Sometimes, they're just illusions. Other times, we get a little power and abuse it, as was the case that day. What had I done to my students? I was looking out at a classroom of 27 Cowardly Lions, and I had created them. How? That's easy: threat. I *never* use threat in the classroom . . . *unless I am under stress . . . unless I feel threatened.* Why was I feeling threatened?

I had just returned from a relaxing weekend. Why wasn't I handling this situation better? If we compare stress levels to a staircase, with the bottom step being a stress-free condition and the top step being very stressful, we can see what my weekend did for me. On Friday, when I left school, I was on the top step. I had just about had it. I was unwilling to talk to my students or my colleagues. The weekend was great, but had I managed to get back to Step 1? Actually, in that short period of time, it would have been very difficult. I probably returned on Monday to school on about Step 5. It felt so much better than the top step had, I thought I was in excellent emotional condition. The moment a stressor revealed itself, I took a giant leap right up to the top. I needed to figure out how to get to the bottom step—and try to stay there.

Brain research tells us that in a classroom or business situation, hierarchies develop. It's a natural phenomenon. People form groups, and some wind up on the top of the heap, whereas others find themselves stuck at the bottom. The individuals at the top have power. They like to keep it that way. Those at the bottom are experiencing the most stress (Sylwester, 2000). When my life and my classroom were running well, my stress levels were low. When things got out of hand, I became the most stressed individual in the room. To

get that power back, I had to put stress elsewhere. In this case, I stressed the entire class. The question I had to ask myself was "How do I end this cycle?"

Brain research tells us that in a classroom or business situation, hierarchies develop.

My Theory of Negative Replacement

I started by looking at my class. What did the hierarchy look like? It was easy to see that Jay was on the bottom. He was always in trouble. What were his stressors? Jay was behind. He had become the class clown in recent months. Did this cover up his lack of academic success? No, it really just disrupted the classroom and took us off task. *On task* was a problem for Jay. If I could get Jay on track, perhaps he would feel less stress, be less impulsive, and my stress levels would go down.

Through the brain research I had been reading I realized that if I could *fix* Jay, someone else would then be at the bottom of the heap, and that brain would need to do something to affect my hierarchy. For years, I have called this the *theory of negative replacement:* the phenomenon of the most difficult student moving to another school only to be replaced by another problem student. Brain research backs that up. How does one keep the situation from occurring? How could I make the classroom less stressful for the kids and for myself? I had to emphasize the fact that I needed to take care of myself in order to take care of my students. What strategies would make my classroom run more smoothly? What tools would the brain research support that would also support me in my classroom? Could I really get rid of the Wicked Witch?

Emotions, Attention, and Learning

Emotions are the source of attention. Without attention, there is no learning (Sylwester, 2000). By dealing with the Tin Woodsman in Chapter 4, I knew that I was working on emotional intelligence. But I also had to look at other strategies to keep my classroom managed and my students attending.

I first chose to look at focus time. How long can I keep my students attending to task? There are differing points of view on this. Some use the *10, 3, 7* system. For the first focus, 10 minutes are available; then comes a 3-minute diffusion time and a second focus of 7 minutes (Benesh, 1999). Dr. David Sousa (2000) refers to the *primacy-recency effect*. He believes that 20-minute lessons with downtime are the most efficient. In a 20-minute learning experience, there is about a 13-minute prime time for learning, 2 minutes of down time, and a second prime time for about 5 minutes. Although these strategies work for many teachers, I have always used the rule of a child's age in minutes. On a good day, a 10-year-old has about 10 minutes of focusing availability. So, after about 8 or 10 minutes, it is time to do something different. Students need processing time, which gives them an opportunity to act on their learning (Sprenger, 1999).

I knew I needed to make myself more aware of my time management. It seemed obvious that this particular group of students varied a great deal in development. There were differing emotional levels as well as different focus times. I was not handling my audience well. I was not observing carefully what *states* they were in. Another focus was to look at using music more effectively to handle emotions. By making some adjustments in the classroom in these areas, perhaps I would be able to more productively engage my students' emotions, help them attend to learning, and keep the Wicked Witch at bay.

Brain States

At any given moment in time, each of us is experiencing a state of mind. We might think of them as moods, but they are really more temporary than that. These states affect what information we may acquire because they affect what we are attending to. The brain is constantly learning and trying to make sense of input. It must go through several different states to acquire information. A process called the *learning loop* explains these learning states.

The brain is constantly learning and
trying to make sense of input.
It must go through several
different states to acquire information.

Keep in mind that states are simply moments in time. At these moments, a combination of our physiology, our feelings, the pictures in our mind, and the sounds around us determines our behavior. For example, sit up straight and look at the ceiling. Put a big smile on your face. In this position, with that smile, it is probably very difficult to be "depressed." Sit more slumped in your chair, look down at the floor, breathe slowly, and frown. It is more difficult to be in the state we call "happy." It is easy to change either of these states. Move. That's it. Change that physiology. Look up instead of down. Stand up. Move around. Every movement affects brain chemistry and can affect the state that you are in. Movement changes the body and the brain. It will increase respiration and heart rate as well as brain waves. Neurotransmitters and hormones will be released through movement that will enhance learning (Jensen, 2000c).

We are even willing to pay for a state change! Have you ever gone to a sad or scary movie? Ridden the highest possible roller-coaster? Listened to a song you knew would make you cry? Headed for the refrigerator when you were tired, stressed, or exhilarated, but not truly hungry? We have all done these things without knowing why. We simply needed to change our state. There are times when we need to change the way we are feeling or looking at things. These are states. From a biological point of view, what we are doing is changing the balance of neurotransmitters in our brains.

When it comes to learning and memory, we need to be aware of positive learning states. Students need motivation to learn. An important way to do that is to appeal to their preferred modality or learning style. All states are dependent on modalities. A visual person needs visual stimulation; an auditory person prefers sounds. The kinesthetic learner requires movement or touch.

For the learning loop to work, material is presented in different modalities. If the presentation is successful, the student acquires the information. The learner then receives some kind of reinforcement from the teacher. This reinforcement is also modality dependent. An auditory learner needs to hear that he or she did a good job. The visual learner would appreciate a smile or the grade on a paper. The kinesthetic learner needs a handshake or a "pat on the back." From these appropriate reinforcements, the learner convinces himself or herself that he or she knows.

States to Avoid

What happens to the student who "falls off the loop," the way my student Jay did? The state the learner falls into is usually frustration. I call it the "I don't

get it" state. The visual learners will cock their heads, scrunch up their eyes, and look puzzled. The auditory learners may mumble to themselves, start talking to those around them, and perhaps shake their heads. The kinesthetic learners will start moving and looking for something to do. As a kinesthetic learner, Jay usually did something physical.

At this point, whenever you find your students going off task, it is time to evaluate the lesson and make some changes in the way you are presenting the material. For instance, if you notice that the majority of the students off task have puzzled looks, you may not be teaching with enough visual input. It is crucial to remotivate these students.

If you cannot get the student to a positive learning state, he or she then goes from this state to the state of fear. I call this one the "I'm afraid I'm never going to get it" state. In a fear state, the learner is experiencing stress hormones in the brain and body that can interfere with further learning.

It is usually necessary to provide some movement to *change the student's mind*. In the case of single students, I may send them out of the classroom on an errand or for a drink of water. When they return, they may better be able to focus. Asking another student to help may also change the fear state. Perhaps this is the time for some peer teaching or teamwork.

The universal state of fear affects many of us in similar ways. The visual learner, who usually has great eye contact, suddenly looks down. The auditory learner may start talking more but generally will be very quiet, with eyes moving from side to side. The kinesthetic learner may look down and slouch or try to physically hide. One thing is clear: They are all trying to conceal their lack of understanding, and no one is learning.

If the fear is not dealt with, students may become angry or apathetic. There can be outbursts or simply no response. These are difficult states and require one-on-one attention. They may also require counseling. These are the states in which I usually find Jay.

Jay and I both desire the state of success. Starting from scratch may be necessary to prompt him. Remember that the effectiveness of our teaching is equal to the response we receive. If we have caused a negative state, such as frustration, fear, or apathy, it is high time to make some kind of change.

I know from my focus-time rule that I must be changing states when my time is up according to the age of my students. When that appears to be too long, and I can tell by the behavior in the classroom, I need to create more timely state changes. On an individual basis, I can use my knowledge of learning styles to deal with the student.

Brian is in the third grade and is having a problem with division. He approaches the teacher:

BRIAN: I just don't *see* what to do with what's left over.
TEACHER: Brian, didn't you *hear* what I said about remainders?
BRIAN: It *looks* like something's wrong when I *picture* it.
Teacher: You need to practice your listening skills. It should be *clear as a bell* for a student like you.

Once the teacher becomes aware of modality preferences and understands Brian's learning style, the conversation changes:

BRIAN: This doesn't *look* right to me.
TEACHER: Brian, let me show you how this is done. *Watch* carefully.
BRIAN: Oh, yeah, I *see* what you mean.
TEACHER: I knew you'd *get the picture* quickly.

What is so impressive about the procedure is that it is easy. The skill involved in managing the states of others and speaking to their preferred learning style aids learning and relationships. Brian was saved from entering the state of fear and possibly apathy. His self-esteem was kept intact, and his relationship with his teacher was positive.

We are constantly acquiring information about the world around us. When we talk to someone who is not paying attention to us, that person is paying attention to *something*. According to Dr. Emanuel Donchin and his colleagues at the University of Illinois, 99% of our learning is nonconscious (Jensen, 2000a). This means we are unaware of most of our learning; we are not learning it on a conscious level. Information is always being acquired. If we want our students to learn what we are teaching, we must be aware of their states and manage them.

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what we are teaching, we must be aware
of their states and manage them.

Things to Remember:

1. A state is a feeling we have that is a combination of our emotions, thoughts, and physiology.
2. All behavior is connected to state.
3. What we do at any moment in time depends on our state.

States to Encourage

The positive-learning states include curiosity, anticipation, and challenge. When you can recognize these states and elicit them, the classroom runs more smoothly, and more learning takes place. There are certainly other states, but these are critical. When you have aroused curiosity in your classroom, your students may have their eyebrows raised (visual), their heads tilted (auditory), or be leaning forward (kinesthetic). Anticipation usually creates students who are sitting up straight with their eyebrows raised (visual), talking excitedly with their heads tilted (auditory), and moving a bit with their bodies leaning into the learning arena (kinesthetic). Some learners will be looking around alertly (visual), talking confidently and excitedly (auditory), and moving rapidly when challenged (kinesthetic).

State Changes and Classroom Management

Because our students can be in different states at any one time, it is imperative that we learn to elicit certain states. We try to keep them at the same emotional level. We want their attention. There are ways to do this that add to the learning experience rather than detract from it.

Switch roles. Ask a student to come to the front of the class and reteach any part of the lesson. Students are curious to observe their peers and often attend carefully to find mistakes.

Stand up. Asking students to stand while you present information for a few minutes quickly changes their physiology and their state. It will change their breathing and cause the release of neurotransmitters such as serotonin, dopamine, and norepinephrine. These aid in learning.

Breathing. Ask your students to take deep breaths. This will change their physical state and give much-needed oxygen to the brain to help them learn.

Put on some background music. While you are speaking, walk slowly to your boom box and play some low-volume music. Continue the lesson. This change will arouse your students.

Change your teaching spot. If your students have to move in their seats to see you or watch something you are doing, that simple movement may change their states and bring them back on task. (I have actually walked over to a table and stood on it! That really got their attention!)

Call for consensus. Simply stop where you are and ask, "All those who agree with what I just said raise your hands." The students who are off task will

quickly realize something is going on when they see or feel the rush of hands being raised.

Repeat what I said. Say "Turn to the person on your left and repeat my last sentence." The movement and the realization that they may have been "spacing out" will bring them back.

Some state changes may have to be more drastic and do take away from the learning momentarily. This may be necessary if the other changes aren't effective. You can send the students for drinks of water, stretch, play "Simon Sez" (I always played "Sprenger Sez"), tell a story, tell a joke, or change seats.

Keep in mind that you are managing the emotional states of your students. This is the most important job you have. The emotional-learning connection is the key to helping our students learn and remember.

Music

I have mentioned in previous chapters that I use music for ritual and as a carrier of information. Now, I present the use of music to engage and soothe emotions and for classroom management. Music is known to help release emotions (Pert, 1997). It also is a valuable tool because every song has a beginning and an end. Each of these can be used as a cue for managing the classroom.

Music is known to help release emotions.

Music and Emotion

Research has shown that music causes the brain to release endorphins, the body's own pain reliever. When there is no pain and endorphins are released, the body experiences a pleasurable feeling. To prove this, endorphin blockers were given to an experimental group. When their favorite music was played, they indicated that they did not get the same good feelings they usually did and therefore did not enjoy the music as much (Jourdain, 1997).

You know those silly-looking people who drive alone in their cars and dance around in their seats as they sing along with the radio? I am one of those people. I listen to the oldies on my way to work, and I feel great. In the

past, I would get to school, do some of my work, and wait for my students. Their music would always be playing when they entered the room. Some of them would be dancing and singing to the music, but I was not. I discovered that I wasn't playing music that was good for me. I needed to be pumped up just like the kids. So, I changed my opening music to put myself in a positive state.

I realized that whatever music I played, the kids would get used to it and become anchored to it. Anchoring is attaching an emotion or memory to certain music. I needed music that I already had a good anchor to so it would get me into the right teaching state. I switched from the Disney music I had been playing to some Beach Boys and Beatles music I loved. It made a tremendous difference in how I started my day. My students became attached to the music and felt their day was enhanced when it was played. It was not only a ritual, as described in Chapter 3, but also a way to get all of us into positive states.

Brain Waves

Music affects the brain by releasing endorphins and also affecting brain waves. The electricity in the brain is measured in waves. Most researchers work with the four major types of brain waves: delta, theta, alpha, and beta. These waves can be measured with an electroencephalogram (EEG). The speed and regularity of the waves can determine the type of learning that is occurring. Each wave is very different.

Delta. This is the brain wave seen during sleep. These waves cycle 1 to 3 times per second. No conscious learning is taking place during sleep. The brain is firing very slowly. Many researchers believe that this is the time when the brain cleans house; in other words, useless information is disposed of. Current research suggests that the rehearsal of new memories is also occurring. Some studies of rats while they were learning and again during sleep suggest that the learning patterns were repeated while they slept (Wilson & McNaughton, 1994). They appeared to actually be practicing the maze they had been taught!

Theta. This brain wave usually occurs twice during the night. The brain is cycling just a little faster than delta at about 4 to 7 times per second. This is a very relaxed state that usually cannot be achieved on a conscious level. Some people can achieve this state through meditation and other forms of relaxation. It is said that this state is very receptive to learning. Perhaps the "sleep learning" records of the 1950s were a result of a belief that the theta state was accessible throughout the night. Unfortunately, the records did not work. The

theta state occurs just as you are falling asleep. It's that dreamy feeling as you drift off. It also occurs as you are waking. If you wake to a clock radio and a song is playing, you may find yourself singing or humming that song all day. In the theta state, your brain may have absorbed that learning quickly and easily.

Alpha. This brain wave cycles about 8 to 12 times per second. This is still a relaxed state, but it can be accessed much more easily than theta. The alpha state is a state of relaxed alertness. Many believe that it facilitates learning and heightens memory. The alpha state can be accessed through specific types of baroque music. This music has 40 to 60 beats per minute. The music tends to slow down respiration, heart rate, and also brain waves. In so doing, the music causes relaxation and helps many out of stressful situations. I always play baroque music during tutoring sessions and parent conferences.

Beta. I call beta waves the "run, see, go, do" waves. These are the waves that get me up in the morning; they are cycling from 12 to 40 times per second. Some researchers believe that these are the waves we need for new learning and new memory. When you are talking and figuring out problems, you are using beta waves. Beta waves go beyond relaxed alertness to full attentiveness. New research suggests that time is very limited in this state and we must use it wisely.

Your brain always has several different types of waves. However, one of these waves will be dominant. Remember, this electrical activity determines the speed at which the neurons are firing—that is, "talking to each other." When we are in a "hyper" state at times, there may be some confusion. Some call this *super beta* because the neurons fire more than 40 cycles per second. Unusual electrical activity has been attributed to some types of seizures. This very important brain function must find a delicate balance to aid in our learning and living.

As educators, we can use this information to our advantage. Music affects brain waves. When we want our students to relax and slow down, we can play music that has fewer beats per minute. Baroque music, which was composed between 1600 and 1750, is known to do this. One must be somewhat cautious because all baroque music does not meet the requirement of having around 60 beats per minute. Look for the word *adagio* on the selection. This indicates a slower piece.

I always use baroque selections at testing time to reduce test anxiety, but it can also be used in other situations. After lunch, when my students sometimes come to the classroom wound up from recess, I often play this music to calm them. For the late afternoon study period, when students are more likely to want to talk than work, baroque music can also be helpful.

Because teamwork is a large part of my classroom practice, music also helps me rouse my teams for action. For brainstorming and problem solving, I want music that is faster than baroque because the students require beta waves for this work. I usually play a classical piece for this, by composers such as Mozart or Beethoven.

The music affects students' levels of arousal, which affects the states they are in. I may begin a lesson with the theme from the movie *Jaws* to perk their curiosity. For challenge, I may play the theme from *Mission Impossible*. Before we leave the building for recess or PE, I can play "Walk in the Sunshine," by The Brady Bunch. In these ways, I can use music to elicit the state I desire for my students and help them handle their emotions.

Music for Management

The music playing as my students enter the room affects their states and also helps with classroom management. When the music stops, my students know it is time to be in their seats quietly because class is going to begin. I also have a "call back" song for my classes. If they are working on an activity and I want them to wind it up and be ready to share information, I play the song. They know that when it is over, they should be in their seats and ready. This same song can be used to send them out for drinks or for pencil sharpening.

If I want students to clean up quickly, I will play the theme from *The Lone Ranger* ("The William Tell Overture"). All cleanup must be complete by the time the song is over. At the end of the day, when it is time to gather homework materials and put school supplies away, I may play "Happy Trails," by Roy Rogers or "Wonderful World," by Louis Armstrong. These songs pleasantly prepare them for the trip home and give them a positive feeling about school.

There are many other ways to use music. It takes only imagination, a cassette or CD player, and some music. Music can be downloaded from the Internet, purchased inexpensively, or if you are lucky as I have been, donated by students and parents. You probably have your own music library at home with selections you can use in your classroom.

The Wicked Witch Is Dead

Okay, maybe she's not really dead, but she's definitely under control. By more effectively managing my classroom, I handled my stress levels and those of my

students. Of course, there can still be days when the witch tries to show herself. I know that I must look around my room to see whose brain is doing its best to create that stress. Rather than doling out punishment, I know this is the student who needs special attention. Before giving it, I use my music and state management to carefully adjust the tone of my classroom.

> Jay is at it again. I am trying to explain to the teams how they are to continue with their projects. I glance at the clock and realize they have been listening to my voice for about 13 minutes. I can either reprimand Jay or try a state change for the entire class. If Jay is jumpy, there are probably others who are also feeling the same way.
>
> I slip over to the boom box as I continue talking and start playing "The Hokey Pokey." The eighth graders quickly stand, and for 2 minutes, we are all "turning ourselves around." When the music ends, I finish my instructions, and the teams get busy. Jay is back on task. I stay close to his team to be sure he understands the instructions and is doing his part. If he needs help, I am there.
>
> Long live the Good Witch!

WIZDOM

- Managing and eliciting states make teaching much easier. Discipline problems almost disappear as your state changes keep the class moving at an enjoyable pace.
- Music can be used in several ways: as a carrier of information for automatic and emotional memory, as a way to control your students' arousal states (quiet them down or speed them up), and for classroom management. Check out this music Web site: http://www.musica.uci.edu/index.html
- Take care of your own personal needs. The less stressed you are, the easier it is to recognize the needs of your students.

7

Dorothy: Teaching Different Brains

It must be inconvenient to be made of flesh,
for you must sleep and eat and drink.
However, you have brains, and it is worth
a lot of bother to be able to think properly.

—The Scarecrow

My daughter, Marnie, is in second grade when the first call comes. It is her teacher, Miss Hill. "I'm having a little trouble with Marnie. She won't sit quietly in her seat." Marnie hasn't been able to "sit" anywhere. I think back to our car trips with her as a baby and toddler. She kicked and screamed throughout every trip; she couldn't stand to be confined in a car seat.

"We'll talk to her and take care of it," I reply.

Scott laughs when I tell him about the call. "We can't get her to sit still long enough to have dinner with us! How are we going to make her sit in a desk all day? Doesn't that teacher know that kids need to move?"

We try talking to Marnie. We tell her how she has to work this out. If her teacher wants her to stay in her seat, then she has to do so.

About 2 weeks later, the phone rings. It is Miss Hill. "Mrs. Sprenger, is there something wrong with Marnie? She keeps falling off of her chair."

Immediately, my mind goes back to the dining room. Sitting still at dinnertime was a battle in her younger days. Marnie would move around so much on the dining room chair that she would often lose center and fall off!

"Miss Hill, I think Marnie is having trouble sitting for long periods. She is moving around on her chair and losing her balance." The woman probably thinks I am crazy, but she seems to accept my explanation.

As the years go by, there are many phone calls. Marnie can't sit. Marnie isn't turning in her work. Marnie's desk is messy. It gets to the point where Scott and I flip a coin to see who has to go to Marnie's conferences. They tell us she is a happy, delightful child. She doesn't really cause trouble. . . . If only she would sit and work like the other kids. If only she would pay attention in class. We are sick of the complaints.

By high school, Marnie figures it out. In 10 minutes in almost any class, she can start to daydream or fall asleep.

During Marnie's sophomore year in high school, I am traveling for the state board of education. I call home each evening. It is midweek, and Marnie answers the phone. She is congested from a cold and cough.

"Marnie, you'd better take care of yourself. Take some vitamin C, drink plenty of fluids, and get some sleep!"

Her reply says it all. "Don't worry, Mom, I'm getting plenty of sleep. I'm sleeping in history. I'm sleeping in chemistry, I'm sleeping in English!"

Josh, our older child, did well in the traditional setting. We always said he knew how to play the education game. Marnie just didn't have the rulebook for that game. Here were two kids with similar genes, the same parents, and yet very different brains. Even with the same environment, we have two unique individuals with unique brains. What do those brains have in common? Do they have the same basic needs?

The Care and Feeding of Dorothy's Brain

Dorothy's experience in Oz indicates that she has a very adaptive brain. Her ability to handle her new situation and solve problems is based on the patterns previously stored in her brain. What does it take to have a healthy brain that can easily find patterns and solve problems?

It's easy to begin with some basics: oxygen, water, glucose, protein, and sleep. About every fourth heartbeat provides needed sustenance for this 3-pound organ. Blood carries the necessary oxygen, water, glucose, and protein. Thirst is an indication that the level of water in the blood is low. Dehydration quickly causes havoc in the brain. It can dramatically affect attention. Students should be allowed access to water on a constant or consistent basis. Some teachers are reluctant about having water available in the classroom because they fear the novelty will be detrimental to the learning process. It really doesn't take long for the novelty to wear off, and the presence of water bottles or coolers becomes part of the learning environment.

Brain Food

Dorothy's brain needs proper nutrients. As educators, we cannot be in control of what our students consume; however, we can be good role models and share with parents the proper diet for a healthy body and brain. Many students skip breakfast, which may very well be detrimental to learning. This is the brain/body's first opportunity to fuel up for the day after several hours of fasting. The brain needs glucose to expend energy and send those messages. Dr. Marian Diamond (1999b), famed neuroscience researcher from the University of California at Berkeley, and others (Carper, 2000; Howard, 2000; Whitaker, 1999) offer many nutrition suggestions to aid the brain.

- Vitamin B1 helps the brain use glucose and promotes the release of neurotransmitters. Food sources include green leafy vegetables, citrus fruits and pasta.
- Vitamin B6 aids in the metabolism of amino acids, which are the building blocks of neurotransmitters. Potatoes, bananas, turkey and whole grains are good food sources.

- Vitamin B12 helps build red blood cells and aids memory. Two good sources are tuna and liver.
- Calpain works to keep connections between neurons clean. Dairy products provide calpain.
- Choline is the precursor to acetylcholine, the neurotransmitter involved in forming long-term memories. Tofu, soybeans, egg yolks, and peanuts are sources of choline.
- Vitamin E improves memory by improving circulation and adding oxygen to the brain. Although this vitamin may be found in foods, 200-IU supplements are often recommended.
- Magnesium improves memory and is found in dark green leafy vegetables, peanuts, and bananas.
- Potassium is necessary to transmit messages. Bananas, green leafy vegetables, and potatoes are sources of this substance.

In general, those who are getting a balanced diet and an appropriate number of calories each day are probably getting most of the necessary nutrients. However, many of our students make unwise food choices and need to be guided in their eating habits. As primary role models for our students, we must model good nutrition. This might mean forgoing that can of soda that may sit on our desk during the day. We can also discuss our food choices and the fact that we begin our day with a healthy breakfast. Considering the growing number of eating disorders, it behooves us to not mention any *diet* we may be currently following. Eating well and exercising should be the messages we send to our students and to their parents. A chart of the basic food groups may be a proper peripheral for the classroom. As students' eyes wander around the room, their brains may absorb this pertinent information in a nonconscious manner.

As primary role models for our students,
we must model good nutrition.

Sugar can aid in memory. Studies show that 30 minutes after candy is eaten, brain glucose levels are high. This could help in a testing situation because we know the brain requires glucose; however, an hour and a half later

when blood sugar has dropped, the student will be at a disadvantage (Ratey, 2000). Sugar consumption before and during school puts children at a disadvantage some time during the school day. Several studies suggest that students on high-sugar diets score lower on IQ tests. Some also have mood swings and earn low grades (Carper, 2000).

Protein is essential to the brain. Digestion causes protein to be broken down into amino acids that make up many of the brain's neurotransmitters. It is important to have protein at each meal; however, an excessive amount is not healthy. Three or four small servings are sufficient (Whitaker, 1999). Students often eat a disproportionate amount of carbohydrates. Because carbohydrates cause the release of serotonin, sleepiness may be a result of this excess. It may be best to encourage students to save those carbohydrates for after school, when they don't need to be attentive.

The most important meal of the day may very well be the first. Studies have shown that students who eat a balanced breakfast including protein, fat, starch, and sugar perform better. They may have better attention, fewer mistakes, faster retrieval of information, and better concentration (Wolfe, Burkman, & Streng, 2000).

Sleep and the Brain

My first-hour class has the lowest scores of my five classes. As I look at my grade book, I see that they turn in less homework than any of my other groups. And they never get involved in discussions. I really am tired of trying to get them interested in learning. They don't even seem to hear my music! I ask the other teachers what their experiences are with this group. The science teacher can't believe that we're talking about the same group of students. They come to her fifth hour, and they have the highest scores in the seventh grade. The math teacher agrees that they are very bright, but he also has some problems keeping them quiet. Quiet! I can't even get them to speak at all!

As we continue to compare notes, the social studies teacher starts complaining about her first-hour eighth-grade class. "They are awfully well behaved, but I can't get a discussion going with them. I may as well be on video with the lack of response I get."

The fifth-grade French teacher pipes up, "My first-hour class is like that, too. It's very difficult to tell if they have the vocabulary. It's as if they're still asleep!"

Sleep deprivation is a major problem in our society. It was believed that these problems did not exist until adolescence, but recent studies show that prior to puberty, children are starting to sleep less. It is believed that children under 10 years old require 9 to 11 hours of sleep. They generally fall asleep easily and are energetic throughout the day. When adolescence begins, our students need 9 hours and 15 minutes of sleep (Dement, 1999).

Sleep deprivation is a
major problem in our society.

Sleep deprivation can cause significant problems. The ability to learn and remember can be hampered. Accidents are more likely to happen. A lack of sleep can contribute to depression, and some sleep-starved children exhibit characteristics of ADD (attention deficit disorder) or hyperactivity. In some cases, students are simply overscheduled. There aren't enough hours in the day for all their activities. Unfortunately, it is sleep time that is taken away (Kelly, 2000).

Many of our middle school students are sleep deprived by the time they enter sixth grade. As a result, their attention and concentration may be affected. Why aren't our students getting enough sleep? There may be a relationship between lack of sleep and bedtime enforcement (Bower, 2000). Changes in the brain at adolescence change the biological clock, a cluster of neurons that send signals throughout the body and controls fundamentally all the internal operations. These changes may be occurring at a younger age in some students than was previously thought. One of the operations involved in the change is sleep. The time at which melatonin, the chemical released to induce sleep, is distributed in the brain suddenly becomes later, so these students are not ready for sleep. Add to that the desire to be more independent, the need to control one's own life, and the fact that older teenagers work late hours—and a problem exists. What's more, those chemicals needed for sleep are still in the bodies of older students during first-hour class. The schools in Edina, Minnesota, changed their starting time from 7:25 to 8:30 and found better grades, higher test scores, and happier teachers and students (University of Minnesota, 1997).

The brain needs sleep to dispose of trivial data and practice new information (Dement, 1999). Sleep also appears to be necessary to regulate emotions, and emotions are already a problem for the adolescent age group. This

combination may contribute to the recent increase in violence (Carskadon, 1995). If sleep deprivation is becoming more universal in that it includes students in primary grades, will we be seeing lower test scores and more emotional upheavals?

Changing starting times would be helpful. A later starting time for middle- and upper-grade students would allow them to get more sleep. Short of that, be aware that your first-hour students may not perform as well as your other classes. Repetition and out-of-class work may be necessary for these students to stay on track. Rotating schedules will help this situation. I was involved in a rotating schedule for several years; both students and teachers loved it. This simply means starting Tuesday with second hour instead of first, Wednesday with third hour, and so on. In this way, it takes 6 or 7 days before that first-hour class is back in your room at the beginning of the day. This is also an excellent way to see how students perform at different times of the day. Let's face it—last-hour classes can be a challenge for teachers *and* students. If you have a self-contained classroom, you have some control over what is covered in the early morning.

Very young students may be negatively affected by a later starting time. Their biological clocks have not changed as dramatically as the adolescents', and they have a tendency to awaken early. Positive effects have been seen in studies of elementary schools that made their starting times earlier. Students appear to be more alert throughout the day and eager to learn (Kubow, Wahlstrom, & Bemis, 1999). The 2 to 3 hours they may spend at home before school may be their most attentive time.

What about naps? Researchers say that up to a 45-minute nap can be helpful. Beyond that amount of time, a full 2 hours is suggested so the body can go through a complete sleep cycle (Brink, 2000). Remember that this is only playing catch-up. Is it time to initiate a siesta period at school?

This is another area in which we must be role models. Rather than sharing the fact that we did not get enough sleep, we should be promoting good sleep habits. We should be proud of getting the 8 hours of sleep we need rather than boast that we require so little to operate.

Exercise

About 20 minutes of exercise makes you less likely to contract up to 50 different diseases. It reduces the likelihood by only about 1% (Sapolsky, 1999), but what an easy and important way to take care of yourself! Almost

everything we read tells us how important exercise is for our bodies. What does it do for our brain?

Only in the past few years has science recognized that the brain grows new neurons. The process, neurogenesis, continues throughout life. Exercise encourages this process by increasing blood flow to the brain. As the blood flow increases, new blood vessels develop to adequately handle the supply. The increased blood vessels act as insurance. If some of the vessels are damaged or blocked, there are others to take over their duties. This decreases the likelihood of further damage. Remember that blood provides all the nutrients the brain needs. So, from exercise we have more blood and more nutrients to keep the brain growing. Studies of rats found that with more complex exercise, more blood vessels and more nerve cells developed (Ratey, 2000).

At the same time, exercise serves another function. The increase in nutrients and oxygen also helps the brain rid itself of debris. The glial cells that serve the purpose of digesting parts of dead cells are able to do this more easily.

Exercise also causes the brain to release other important nutrients called growth factors. Several studies suggest that the growth factor, brain-derived neurotropic factor (BDNF), is released after voluntary exercise. This substance actually can increase cognition as it helps with neuronal communication (Stern & Carstensen, 2000). William Greenough, at the University of Illinois, experimented with rats and exercise. One group of animals ran across ropes and bridges, and another group ran on an automated wheel. A third group remained sedentary. The group that needed the precise movements for the ropes and bridges had a greater number of connections among neurons in their brains than either of the other two groups (Hannaford, 1995).

There are many health benefits from exercise. Reducing depression is one of them. This probably relates to the release of the neurotransmitters that affect mood, serotonin and dopamine, and the decrease of the stress hormone cortisol. Sleep is often enhanced as well (Giuffre & DiGeronimo, 1999). Memory function may improve as a result of these benefits.

How much activity is enough? Thirty minutes per day at least 3 or 4 days per week is usually recommended. The more organized, challenging, and well executed this movement is, the more beneficial it will be. If your school does not provide physical education classes, recess may be the only time for proper movement. Recesses should be at least 30 minutes long. Short recesses may excite kids and leave them overaroused. Concentration could be hampered. Of course, recesses shouldn't be so long that students have little energy left (Jensen, 2000c).

Unique Brains, Unique Learners

Two years ago, I began teaching a graduate-level class that I had designed, called "Teaching Different Brains." The class was a result of the diversity my colleagues and I were finding in our classrooms. It appeared that every child needed an individual education plan. I wanted to help every student, yet I was hopeful that there was a way to find the similarities among their unique brains, capitalize on those, and then modify my teaching and facilitating to meet the special needs.

As I started gathering biological information, I realized that the number of possibilities was quite extensive. Acquiring an understanding of the different types of brains affords more creativity as well as a better understanding of how teaching style affects them. I also wanted to offer any educator the opportunity for much-needed substantive dialogue about the concerns of meeting student needs.

The types of brains we study in my class include, but are not limited to, the following:

- Addicted brain
- Autistic brain
- Anxious brain
- Attention deficit brain
- Behavior disordered brain
- Depressive brain
- Dyslexic brain
- Epileptic brain
- Fetal alcohol syndrome and fetal alcohol effect brain
- Helpless brain
- Impoverished brain
- Obsessive-compulsive brain
- Oppositional brain
- Sleep-deprived brain
- Traumatized brain

After discussing the available research on each of these brains, participants are asked to "pick a brain" for further study. "Brain teams" are formed. Since the class's inception, most teachers seem to focus on three unique brains: depressive, helpless, and attention deficit. Although these brains require the same nutrients, sleep, and exercise as other brains, other needs must also be met.

The Depressive Brain

As educators, we must be extremely aware and concerned about depression in our students. Emerging research suggests that even mild depression

from which there is complete recovery may cause permanent damage to the hippocampus (Restak, 2000). This structure is vital to factual memory. Therefore it is very important to be aware of the signs of depression to ensure that our students receive expeditious and effective treatments.

People with depression find little pleasure in their lives and see the world in a distorted or negative way. The symptoms of depression may include the following:

- Sadness and/or irritability that persists
- Low self-esteem or feelings of worthlessness
- Loss of interest in previously important and favorite things
- Change in appetite or sleep (either increase or decrease)
- Difficulty concentrating
- Physical pains that seem to have no cause, such as headaches and stomachaches
- Activity level changes—either more hyperactive or more lethargic
- Thoughts of death or suicide

The key to recognizing depressive problems is to watch for change. Any variation in a child's behavior that appears to have no external cause should be checked out. If a student has an obvious concern, such as a loss, divorce, or a move, and you see a change that lasts for more than a few weeks, it should be considered a possible depression. Other mental disorders often accompany depression. Two possibilities are ADD and eating disorders. These need to be treated along with the depressive disorder for effective treatment (National Institute of Mental Health [NIMH], 2000).

The key to recognizing depressive problems is to watch for change.

There are certain risks associated with depression. Among them is an increased risk for illness. Depression suppresses the immune system just as stress does (as discussed in Chapter 3). It also increases the risk for substance abuse and suicidal behavior, especially in adolescents. Unfortunately, signs of

depressive disorders in young people are often viewed as normal mood swings associated with a particular developmental stage.

Of American children, 5% may be depressed, according to the American Academy of Pediatrics (Jensen, 2000b). As you look at your class, ask yourself some questions about which students exhibit the following behaviors:

- Frequently absent?
- Performs poorly?
- Talks of or has tried to run away from home?
- Outbursts of shouting, complaining, unexplained irritability, or crying?
- Acts bored?
- Lack of interest in playing with friends?
- Signs of alcohol or substance abuse?
- Trouble communicating or isolating themselves socially?
- Expresses a fear of death?
- Extreme sensitivity to rejection or failure?
- Increased irritability, anger, or hostility?
- Reckless behavior?
- Difficulty with relationships?

The causes of depression are numerous and vary with each individual. Genetics can play a role. Those who are genetically prone to depression may (a) secrete more cortisol during a stressful time, (b) have an imbalance in their serotonin and norepinephrine systems, or (c) have a glitch in the feedback loop that stops stress hormones from being released (Sapolsky, 1998). In this way, nature and nurture probably play somewhat equal roles. The environment may provide the stressors that cause any of the genetic propensities to be expressed.

Which areas of the brain are affected by depression? Some areas of the brain become overactive, whereas others become underactive. Overactive areas include the cingulate cortex, which locks attention on sad feelings. Sad memories are held by the lateral prefrontal lobe, and the thalamus stimulates the amygdala, the creator of negative emotions (Carter, 1998).

There may be decreased prefrontal cortex activity with increased activity in the limbic area of the brain. This combination often causes the depressive

person to be moody and negative, with low energy and sleep and appetite problems. Because of the problems with dopamine and norepinephrine, this student would have trouble concentrating. An area known for serotonin fibers, the anterior cingulate, located behind the frontal lobes, may show increased activity along with the thalamus and the basal ganglia. A student with this condition may be sad, irritable, and stuck in negative thought patterns. Decreased prefrontal cortex activity with a change (increase or decrease) in temporal lobe activity could result in sadness, irritability, or even rage (Amen, 1998).

Fortunately, we don't see a large percentage of students with depression. However, the statistics are growing. More than 500,000 children in America take antidepressants. In the adolescent population, 1 in 8 may be experiencing depression (NIMH, 2000).

As educators, we have the opportunity to observe children in different settings. If you find a student to be symptomatic of depression, seek help. Counselors, school psychologists, and parents need to be aware of a possible problem. After that, there are some provisions to make as a teacher. Creating a positive environment with social support and plenty of consistency may be helpful to the depressed student. Because the neurotransmitters that affect mood are generally at low levels in these students, providing movement and exercise may encourage their release. Perhaps a "walk and talk" in nice weather would provide a release of dopamine, serotonin, and endorphins. It would also provide some social support and a verbal outlet if the student wanted to talk. Combine the walk with academics. An example would be, "Today we are going outside for a walk and talk. You are to share three things with your partner: one concept you learned today in science, one question you need answered concerning another subject area, and one thing you are going to do to make yourself feel good today. After you and your partner have covered these areas, you may talk about anything you wish. Be finished and line up at the school doors in 15 minutes."

Treatment will vary with the individual and the type of depression. It is rare that depression improves without some kind of intervention. Often, both medication and talk therapy are necessary. Antidepressants may be prescribed for a short time until no longer needed.

The Helpless Brain

Learned helplessness is a disorder in which cause and effect no longer connect in a child's brain. Students have been exposed to chronic failure and

feel that nothing they do will have an effect on their situation. This is a learned condition, not a genetic one.

Research on psychological suffering using animals in laboratory settings found that helplessness can be taught easily and reversed with some effort. At the University of Pennsylvania, researchers found that if they shocked the floors of dogs' cages, after some effort at escape, the dogs simply curled up and took the abuse. Even after the dogs were shown how to escape the shock, many had learned that what they did made no difference in their plight and continued to be shocked. It took experimenters dozens of times of showing the dogs where safety could be found before the creatures would venture to the unelectrified area. The problem was not the shock but, rather, the dogs' inability to do anything about it (Seligman, 1995).

These experiments have been performed on a number of creatures, including humans. In one such study, student volunteers were exposed to loud noises. One group could escape the noises; the other could not. When later given a learning task that would cause the noise to cease, the group who experienced the inescapable noises had more difficulty learning the task. It appears to be quite easy to induce helplessness in humans (Sapolsky, 1998).

Here are some signs of learned helplessness:

- Lack of motivation
- Cognitive distortions—"the glass is always half empty"
- Apathy
- Increased sarcasm
- Unresponsive to new and interesting stimuli
- Feeling or perception of lack of control over situations
- Feeling of powerlessness

What is going on in the brain of the helpless student? Corticotropin releasing factor (CRF), the substance released by the hypothalamus to cause the release of stress hormones such as cortisol, is elevated. The release of cortisol may become continuous, eventually damaging the hippocampus. There are depletions of serotonin, dopamine, and norepinephrine. Norepinephrine is usually released when new stimuli are introduced into an individual's environment. In the helpless individual, there is a lack of interest and motivation. The immune system is depressed in these individuals, making them more vulnerable to illness (Giuffre & DiGeronimo, 1999).

Learned helplessness can be cured with effort, and fortunately, it can be prevented. To cure helplessness, students must be taught that their actions have effects. This may take great effort and repeated experiences to change the brain. Preventing helplessness must include early experiences with mastery (Seligman, 1995).

The key to this condition is *control*. When students feel that they have no control over their experiences, they may develop learned helplessness. Giving students more control in the classroom is a step toward prevention. In the case of students who believe they have no control, simply offering the option won't help. These students must experience being effective:

- Play games that require everyone's participation.
- Provide and discuss choices and consequences of those choices.
- Provide an agenda or preview of the day's activities to give students predictability and a feeling of control.
- Provide time for journaling and talking.
- Provide movement to release "feel good" neurotransmitters.

Therapy may be necessary for some students with this disorder. Helpless students can become depressed. We must remember that it takes time to rewire the brain. Spending time with these students and addressing their negative thoughts and perceptions would be helpful. It is not always a perfect world in the classroom, and time is not always available; however, learned helplessness can be alleviated with time and effort. Be an optimistic role model for your students. They look up to you and may want to adopt your outlook.

The Attention Deficit Brain

Attention deficit disorder (ADD) is the most common neurobehavioral disorder of childhood, and one of the most predominant chronic health conditions affecting school-age children. Inattention, hyperactivity, and impulsivity are core symptoms. Academic underachievement, trouble with interpersonal relationships, and low self-esteem may be experienced as well. ADD is found in association with other disorders, such as oppositional defiant disorder, conduct disorder, depression, anxiety disorder, and also with speech

and language delays and learning disabilities (American Academy of Pediatrics, 2000). Children with ADD continuously concentrate and focus on the newest or most demanding distraction that is present. About 4 million American children are taking medication, such as Ritalin, to treat this problem. Every day, stimulants are being prescribed for about 1,400 new children (DeGrandpre & Hinshaw, 2000).

ADD is a condition that involves three problems in the behavioral and cognitive areas:

1. The inability to focus attention for periods of time
2. Difficulty in controlling impulses and delaying gratification
3. Deficiency in controlling movement

Diagnostic criteria:

- Symptoms must begin before the age of 7.
- Symptoms must be persistent over time.
- Symptoms must be present in different situations.
- Problems must be extreme for the age and developmental level.

The causes of ADD include heredity. *DR4R* has been identified as a gene responsible for coding for the dopamine receptor. This is a susceptibility gene that may interact with the environment to create a potential for the disorder. Low birth weight and smoking during pregnancy may be biological risk factors (DeGrandpre & Hinshaw, 2000).

What does an ADD brain look like? Imaging studies of these brains show a lack of activity in several areas of the right hemisphere. The anterior cingulate, which is associated with focusing attention, and the prefrontal cortex, which controls impulses and plans actions, are underactive. The integration of stimuli is thought to be controlled by an area in the upper auditory cortex that appears to be underactive as well (Carter, 1998).

Which of your students often exhibit the following behaviors?

- Leave work unfinished
- Have limited short-term memory
- Wiggle and jiggle

- Do not follow through on instructions
- Have difficulty waiting for their turn
- Interrupt
- Have difficulty engaging in quiet or leisurely activities
- Fail to think ahead and be prepared

The guidelines for the actual diagnosis of ADD have been clearly recommended by the American Academy of Pediatrics (2000). They use explicit criteria, obtain information regarding the symptoms in more than one setting, and search for coexisting conditions. Treatment may include psychostimulants and behavior therapy.

Suggestions for dealing with students with this disorder include the following:

- Preview material up to a week in advance. Use attractive posters so students will view them when they are not attending to what the rest of the class is doing.
- Use the morning hours for short-term memory activities.
- Use the theory of multiple intelligences approach to learning to capitalize on student strengths.
- Set limits and rules and abide by them.
- Use positive reinforcement as much as possible.
- Create an inviting classroom and allow personal space to be individualized by each student.
- Role-model organizational skills.
- Provide movement opportunities.
- Introduce new material in a multisensory fashion (puppet shows, role play, etc.).

Some have thought that students with ADD are overstimulated. Recent research suggests that they may be understimulated. They may require more stimulation than other children (Armstrong, 1999). Stimulation comes in many forms, including physical exercise. In a recent study, Caterino and Polak (1999) concluded that the level of focus and concentration in young children improves substantially after physical activity.

Making a Difference

It is estimated that nearly 40% of our students suffer from some kind of learning impairment (Jensen, 2000b). To teach to such diverse groups takes background knowledge in how the brain works and how to cope with some of these disorders. Every brain has some of the same requirements. Sleep, proper nutrition, and exercise are among these. If our students arrive well nourished and well rested, we have a positive starting point.

Brain-research-based strategies have stood the test of time. Some of them enable us to teach a class of students, and many of them enable us to teach each student in a class. They enable us to see that although brains are unique there are strategies available for each.

> It is Marnie's senior year in high school. School is still not always an easy place for her to be. A few weeks ago, Scott and I were out to dinner, and we ran into Marnie's second-grade teacher. I broke into a cold sweat!
>
> Marnie has always wanted me to go to her schools and show her teachers the way I teach—but people don't seem to consider you an "expert" unless you live 25 miles away. I share with her the methods I know, hoping that she can help herself. We watch her struggle with classes and don't comment when our friends' kids bring home report cards. Marnie never seems to tell us when she gets her grades.
>
> After a particularly trying day at school, I come home to an unusually happy child. Before I can get my coat off she says, "Mom, do you remember what you said you would give me for an "A" on my report card?" Before the days of research, I desperately tried to extrinsically motivate my daughter. "No, Marn, what did we offer you?" Her response is quick, "Twenty bucks!" Then it all comes back to me. We had told her that we would give her $20 for an "A," $10 for a "B," and then start deducting for lower grades. I could not remember ever having paid her.
>
> I nod that I agree with her memory. She whips out her report card and starts laughing. Five subjects—five "A"s. It is remarkable. I look at my child in disbelief. "Did you know that you were doing this well?" She just smiles more broadly. "Do you know how you did this?"
>
> As I take my charge card out of my wallet and hand it to her, she explains her accomplishment. "I knew I wouldn't have a problem in

Mrs. K's class, she has us on teams. The other classes are traditional lecture, so I've been inviting my friends over to study. I borrow their notes and walk around the living room while we talk about the material. After I've walked and talked, I own that information." She takes my card, promises to spend only $100, and is on her way to the mall.

Marnie managed those "A"s one more time during that final year. She went on to a university and received a degree in history. When we offered to send her on for a master's degree she said, "This bachelor's degree is for you, Mom. I'm all schooled out. Now I'm going to find a place where I can be happy." She's done that. Her job involves lots of action and very little sitting still.

WIZDOM

- Research suggests the importance of sleep for learning, so share a plan of action with your students. After learning, suggest that they review the material before bed, go to sleep, and review the material again after waking.
- For exercise and movement, *Brain Gym*, by Paul and Gail Dennison (1994), has some proven activities.
- For information about ADD and other disorders, check the American Academy of Pediatrics at http://www.aap.org

8

No Place Like Home: The Learning Environment

No matter how dreary and gray our homes are, we people of flesh and blood would rather live there than in any other country, be it ever so beautiful. There is no place like home.

—Dorothy

Spring is in the air: Birds are singing, and flowers are blooming. It is Day 4 of a school review for the state board of education. Along with a team of reviewers, I have been observing, interviewing, and shadowing students to the point of exhaustion.

The school is neat and organized. The teachers are warm and friendly. They are without a doubt devoted to their jobs and to the children. Their unwritten mission statement appears to be "Whatever these children need, we will provide it."

The problem as I see it is that they don't understand the brain. The goal of the faculty is to have "perfect" discipline. They use a behavioral model. To offset the negative consequences, extrinsic motivation in the form of candy is extensively used. I watch as students lower their hands for a question when they realize they have received all the

candy they are going to get. Why bother thinking anymore? The children walk the halls like little robots.

I sigh as I see how far this school has come and how far it needs to go. The students sit in groups, yet they do no group work. Teachers stand and deliver for 30 to 45 minutes, expecting all students to sit quietly. A lot of teaching is going on, but I wonder how much learning is actually taking place.

Home can be defined as a place to belong. If we want our classrooms to be places where *students feel good about themselves and learn,* we must create an environment for learning that affords a "There's no place like home" feeling. So many educators today are still under the misguided impression that students who sit quietly are the ones doing the learning. They seem to think that the teacher stands at the front of the room and pours out pearls of wisdom that are somehow going straight into those little heads in the classroom and if they don't open their mouths, none of it will spill out!

Alfie Kohn has been writing about the negative affects of reward systems for years. Rewards especially have a tendency to put kids in a "box." If this is what the teacher wants for an "A", for a candy bar, or for a soda, that is exactly what he or she gets. There is no sense in taking a risk and trying something new! I found that students who were less academically oriented often gave up when I offered rewards. Kohn explains how this threatens such students. If I offer a reward for something they don't feel capable of doing, then I am really *threatening not to give them one* unless they can do what the other kids are doing (Kohn, 1993).

What about testing? State-standardized testing is putting a strain on the classroom. Teachers have little time for interaction with their students. The necessary feedback is often forgotten because information must be covered in time for the test. Students are feeling the pressure and want someone to talk to about it. The teachers are too busy to discuss anything other than content. Content is not what is on the minds and in the hearts of most students (Oliveira, 1999).

What I have described thus far in this book are strategies for creating a brain-friendly environment. Understanding brain function, learning styles, states, music, rapport, and memory pathways help kids feel at home. It builds trust in you as their teacher and coach. If you create this kind of atmosphere, students will feel safe and understood. But that isn't enough. Students want to feel academic success. So, the final step in brain-based teaching is making the brain-centered classroom one in which all students feel successful. To

promote long-term memories, self-confidence, and a love of learning, let's look at an enriched environment.

What Are Enriched Environments?

Neuroscience has been talking about the concept of enriched environments for many years. One way that learning affects the brain is seen in changes at the cellular level. Dr. Marian Diamond, of the University of California at Berkeley, and Dr. William Greenough, of the University of Illinois, have done extensive work on enrichment. They have both spent years studying the brain growth of rats in different environments. These studies have offered interesting ideas to the field of education. We do not want to compare our students to rats, but comparing brain growth and composition is worthwhile.

Many of the studies have dealt with the idea of enriched environments and impoverished environments. In one such study (Barber, Barrett, Beals, Bergman, & Diamond, 1996), the control group consisted of lab rats in their normal lab environment: 3 rats in a small cage with food and water. Experimental groups consisted of isolated rats, rats with companions, and rats with companions in a large environment, with toys representing challenge. The challenges were running wheels, tubes, blocks, and bars.

The results of the experiment are interesting. The control group, 3 rats in a small cage with no toys, showed more brain growth than a single rat in a small cage with no toys. It appeared that *socialization* helped brains grow. A single rat in a large cage with toys fared better than a single rat with no toys. *Challenges* seemed to support growth. However, the 3 rats without toys did better than a single rat with toys; hence it appeared that socialization promoted more learning than toys did. Social life encourages challenges, such as problem solving. Calculations have to be made about behavior and its consequences (Calvin, 1996). The 12 rats in a large cage with toys showed the most growth. The enriched environment encouraged wide branching of dendrites. One of the more interesting observations from this study was the comparison of 12 rats with no toys with a group of 3 rats with no toys. Which of them showed more growth? Did more socialization cause more learning to take place? The answer was "No." The 3 rats had more dendrites than the 12 rats. Perhaps too much socialization caused stress. Perhaps this was a case in which individualized attention made a difference.

Does this experiment and others like it prove that rats in enriched environments are smarter? We know they have more dendrites and cortical thickness, but are they brighter than other rats? The answer is "Yes." Those rats figured out how to run through mazes more quickly. The important point is that with the proper environment, brain growth can be seen, and with poor environments, the shrinkage of brain cells can also be seen (Diamond & Hopson, 1998).

Dr. Greenough's similar research suggests that two things are necessary for brain growth through enrichment. The first is that the subject must be challenged, and the second is that the subject must receive feedback. Novelty may be included in the challenge but is not always necessary; however, timely feedback is necessary for learning to take place (Jensen, 1998).

Autopsy studies have compared the brains of high school dropouts with the brains of graduate students. From those studies, it was determined that the graduate students had more brain growth—up to 25% more—than the dropouts. The critical component of this growth was a continually *challenging* environment (Jensen, 2000a).

Of course, there are the now-famous nun studies conducted by Dr. David Snowdon (Golden, 1994). These women from Mankato, Minnesota, whose longevity was astounding to the neuroscientist, donated their brains to his research group. His scientific interest in them concerned not only their extended lives but also their energy and intellectual capabilities well into advanced age. There was certainly some forgetfulness, but most of the nuns remained active and able to perform complex cognitive skills until the end of their lives. Because these women were so mentally active, they had brains rich with dendritic connections. As a result, even some with Alzheimer's disease showed little outward evidence of the brain deterioration associated with the disease. It seems that the more active and challenging your life remains, the more connections you can afford to lose!

Can We Provide an Enriched Environment in the Classroom?

Let's keep in mind that part of enriching the environment includes being cognizant of our students' needs. We want to challenge students and promote dendritic growth. We also want to provide a safe environment in which we can promote self-confidence and a love of learning. We know we need to help our

students meet our state standards, and we want to keep stress levels—theirs and ours—as low as possible. Academic failure is one cause of the stress we see in our classrooms. Stress causes social and behavioral problems as well as depression in children (Tallal, 1999).

Academic failure is one cause of the stress we see in our classrooms.

Neuroscientist Paula Tallal (1999) speaks of enrichment in the classroom. The following learning principles, based on neuroscience research, make changes in the brain:

1. Give the brain something it is able to do.
2. Provide repetition to get neurons firing repeatedly and enable them to become more efficient at firing for that information.
3. Give timely feedback, either positive or negative.
4. Adapt the learning to each child. (Technology may be helpful in the differentiation process: It can track performance and give immediate feedback).
5. Consistency and intensity are important; don't be afraid to repeat!

Brains need time. To digest and adapt new information, the brain needs both time and opportunity (Diamond, 1999a). One thing that attracts the brain is novelty. This attraction may be the result of the brain dealing with survival. Something new and different must be examined to make sure it is not harmful (Carper, 2000).

Enrichment and Assessment: Are They Compatible?

As a classroom teacher, I have felt the pressure of standardized-test time. It seemed that each year I taught, test preparation began earlier. In some classrooms, the entire curriculum is dropped for months as teachers prepare

students for the tests. Education revolves around them. Hence the question, "Can I create a brain-compatible classroom, enrich the environment, and foster the learning my students must have for our standardized tests?"

As I look at the components of an enriched classroom environment, I can focus on the following necessities: predictability, novelty, control, choice, challenge, and feedback. I have already addressed many of these in relation to stress, emotional intelligence, and cognition. Now, we are going to look at each of these in relation to assessment.

I believe strongly that every child wants to succeed. Success is part of what makes the classroom a safe place for many of our students. Our assessment techniques inform our students, parents, administrators, and community members of the success of our students. The journey through school has been a difficult one for those who have had a sense of failure in the assessment arena.

The journey through school has been a difficult one for those who have had a sense of failure in the assessment arena.

Assessment as Predictability

We have defined predictability as the quality of knowing what is going to happen. It gives students an internal locus of control to have this information. Can we make assessment predictable? One way, of course, is not to give any surprise tests. Another is to use practice tests. Standardized test-preparation manuals are available to make students comfortable with the format and style.

Getting the students involved in assessment provides predictability. Students can *help* design the assessments and the rubrics and decide on dates and times. Teachers have seen marvelous results with this approach to assessment. This gives students the opportunity to view the concepts you want them to attain and direct their learning toward them.

Assessment as Choice

Choice is a strong component of enrichment. Making choices involves problem solving. This encourages the brain to search for patterns and connect

the new material to the previously stored material. The blood flow to the neural connections stimulates dendritic growth (Fogarty, 1997).

Giving students choices in their assessments adds to their internal feeling of control. They may be able to assure their success when they choose their assessment. This can be done in a number of ways. Perhaps some units would free you to offer a traditional paper-and-pencil test, a creative project, a written paper, or an oral presentation.

Assessment as Novelty

Is it possible to be predictable and novel at the same time? Absolutely. The novelty may come with the assessment choices. It may come in a creative form, such as directing the students to create a new kind of test that has never been given and will accurately assess the concepts you are working on. Perhaps they will be able to extrapolate the learning to the real world using novel approaches. This enables more memory pathways to be used and offer greater access to the information beyond the assessment time.

Novelty can certainly be offered in the form of performance assessment. Creating videos, hypermedia presentations, puppet shows, interviews, surveys, or graphic organizers may pique the brain's attention and encourage curiosity and risk taking.

Here is a note of caution: Too much novelty causes stress and brain shrinkage in lab animals. Stress is known to kill brain cells in the hippocampus, the structure associated with factual memory.

Assessment as Challenge

The importance of challenge cannot be understated. Diamond (1999a) suggests an appropriate amount of challenge. If a situation is too challenging, students will be overwhelmed. What constitutes challenge? Going back to the steps outlined by Tallal (1999), a challenge would appear at the adaptation stage. Challenge brings with it the feeling of capability. Intrinsic motivation is usually involved: "I know how to do it; I'm interested in doing it; I can do it!" An appropriate challenge would involve only the positive stress, eustress, as described in Chapter 2.

Challenges can include problem solving, decision making, explanation, remembering, planning, evaluation, representation, and prediction (Perkins, 1995). Can these be assessed? They can definitely be included in both traditional paper-and-pencil tests and authentic assessment. The concept of self-

esteem includes the ability to confront challenges and learn from the experiences (Brooks, 1999). Isn't that what we want for all our students?

Even in the studies of rats, brain growth varied according to the kind of challenge. Rats running on wheels showed some new growth and branching, but rats that did more acrobatic feats, such as crawling along a raised pole, showed more growth (Jensen, 2000a).

Assessment as Feedback

This would be the foundation of an enriched environment. Assessment would be feedback rather than a simple determination of success or failure. If we want all our students to succeed by meeting the standards, we must give them continual feedback. Assessment should be viewed as an opportunity to communicate the current level of performance and provide information to enhance that performance. By furnishing students with explicit information regarding their current status in terms of objectives, achievement has been reported to have increased 37%. Feedback is considered to be the most important ingredient to enhance achievement (Marzano, 2000).

Feedback is considered to be
the most important ingredient
to enhance achievement.

If we truly want our students involved in the learning process, they must have the information they need to continue their search for knowledge. Any kind of assessment is an opportunity to give and receive feedback. In a study done with graduate students, those who were given no feedback on a problem-solving simulation lost as much self-confidence as the students who received negative feedback (Goleman, 1998b).

Assessment as Control

I saved this for last because it is a part of all the others. If students become involved in assessment, they will feel some control over their education and responsibility for their learning. They will accept the idea that *their ability determines academic success.* Learning challenges and risk taking are no

longer stressful as students face them knowing that they are able to achieve (Stiggins, 2001).

The new social studies textbooks arrive with all the fancy trimmings: publisher tests, educational software, posters, audiotapes, and videotapes—more than the teacher, Geri, can imagine getting through. The curriculum seems wonderful; she can't wait to get started. She begins using the text, showing some video clips, and having her students listen to some of the tapes.

There is so much material for her to learn and to share with her students, she doesn't realize how much time is passing. She suddenly realizes that it is time to move on to another unit. But first, how will she assess her students? Because this great program has tests included, she decides to give her students the publisher's test for the unit.

It is very disappointing when most of the class fails. What is the matter with these students? She rethinks the entire situation. She covered the material in a predictable fashion. Geri enjoys using the memory pathways for her units, so she had been sure to cover each of them.

The day she passes back the tests, she is very disappointed. She asks the students what they think might be the problem. One student replies, "Mrs. B," as they call her, "that test didn't ask what we learned." "Yeah," says another, "I'm not sure what pathway that test information was supposed to be stored in, but it wasn't in any of mine!" Geri laughs at this, but it makes her think. Had she taught to all the pathways except semantic and then asked her students to share their knowledge in that pathway? That was a possibility, but there was more. The publisher's test didn't really cover the material she thought was the most important! The assessment and the instruction just didn't match.

The following day, Geri asks her students to work in teams to create criteria for assessing the unit. What would a student who truly understood the material, enough for a grade of "A", have to know? After sharing these lists with the whole class and determining "A" criteria, she asks them to create criteria for the other possible grades. When all groups finish, they compare notes. Some argue about a few points, but eventually, the entire class reaches a consensus.

The next day, Geri asks each team to create an assessment. They may choose to create a factual-recognition test, an essay test, or a performance assessment. For either of the latter two, they must create a

rubric. It takes her students 3 class periods to create assessments that satisfied the original standards the class had created.

Then, she offers them the choice of assessment, with the exception of their own. Because of the hard work they had put into creating the standards and their own assessments, the students score well. Enabling them to choose gives them the power to express their knowledge in the format they think will work best for them. Self-confidence is high because the students know that they know the material.

Geri realized that the "book test" had not sought the information she had covered. From then on, matching the instruction to the assessment became a priority. She also realized how empowering it was to share the assessment process with her students. They gained confidence in themselves through the experience. They would often ask to help her set the standards for other learning.

Brain-Based Assessment

The most common types of assessment in use are traditional selected-response tests, essay tests, authentic or performance assessments, and portfolios. Report card grades and conferences are also assessments. Are all of these methods brain compatible? They can be. At issue here is the locus of control. Remember, this is one of your students' basic needs.

I am applying for a graduate program. To be accepted, I must take and score well on the Miller's Analogies Test. I haven't been tested on anything in years, and it makes me a bit nervous. I go to the college bookstore and purchase a practice book for the test. It contains dozens of practice exams along with an explanation of how the analogies should be approached. I spend weeks preparing. I take many of the practice tests, finding some of them easy and others quite difficult.

On the day of the exam, I must drive to a nearby city to take the test at a state university. I am in a strange city, in a strange building, and in a strange room. So much for episodic memory! I am told the amount of time I will have to complete the exam. I am also told to use the restroom or get a drink before I begin because I will not be allowed either until I finish. The exams are distributed, and I begin. It takes me several minutes to get comfortable in the room, but as I look over the

> test, I realize that I've practiced this format enough to feel in control. There are even a few analogies that were in the practice book! I forget about the time constraints and complete the exam with time to spare.

I was able to relax and do quite well on the test because I had the predictability of knowing what the exam would be like. I had some control over the situation. The brain-antagonistic parts of the experience, the strange place and the time limits, were overcome by my self-confidence in the format and the material. I often carry with me a cartoon of a child showing his test paper to his dad. He says, "But Dad, I knew the answers to the questions that weren't on the test!"

Focus

In any assessment we give, both the students and the teacher must be aware of the focus. In other words, what do I expect them to learn and be able to communicate to me through this assessment? Let's face it, we are teaching to goals, standards, and benchmarks. If we align our lessons and units to those, the focus should be pretty clear. Write the focus on the board or put it on a bulletin board. If students ask you why they are doing something, point to that focus. If your students cannot make the connection between what they are doing and that focus, perhaps it's time to reconsider what you have planned.

Method

Once you know what you expect your students to know, produce, or perform, it is time to determine what kind of assessment will give you that information. Will a paper-and-pencil test give you the information you need and the feedback the student needs? Are you able to do this in a selected-response format, or will it require essay questions? These are the kinds of questions you must ask yourself. The focus and the method must match.

Balance

I believe strongly that all the assessment methods when used appropriately have merit. Students must be able to handle all types, and each provides important feedback. Although it is not very "in" to have students memorizing

a lot of material, it is still very necessary for them to have a knowledge foundation to problem solve, reason, compare, evaluate, and create. Processes and products are the result of thinking with content. To assess that knowledge foundation, paper-and-pencil tests work well.

If your focus is to have students speak persuasively, a paper-and-pencil test is not the method to use. It is possible to give students a written test on the parts of a speech, the reasons for support and details, and the merits of the different persuasive formats. To assess their speaking ability, they must perform. The criteria must be carefully selected either by you alone or with your students. Either way, the students must understand the criteria and have that in their hands when they are given the performance task. This will keep them focused, give them a feeling of control, and provide the predictability they need.

To keep assessment balanced, consider the following assessment options:

Paper-and-Pencil Recognition Tests. These include multiple choice, matching, true/false, and fill in the blank. Don't underestimate these tests. They are not simply for factual knowledge. If they are created correctly, they can also assess reasoning and problem solving. Recognition tests are efficient and effective when created well. There are guidelines for creating these items.

Recall or Essay Tests. These can be used in a variety of situations. Criteria must be decided on beforehand. If you are assessing application or reasoning rather than content knowledge, provide the content or give the essay questions to the students to study. Oftentimes, students can apply or reason, but they haven't mastered the content. This gives them the opportunity for valid assessment of the focus.

Authentic or Performance Assessment. These are opportunities for our students to show their abilities and knowledge through a product or performance. Authentic assessment is considered to be a task that might be encountered in the real world. Performance assessment does not have to meet this requirement. Some researchers call both tasks performance assessment because the distinction is unclear (Marzano, 2000). This may be an opportunity for students to see the connection between school and the real world. It requires solid criteria. Authentic assessment can offer challenge, novelty, and choice. Because we have such diversity in the classroom, performance assessment affords students the freedom to create or perform in ways that are compatible with their learning styles or strong intelligences.

Portfolio Assessment. This collection of student work can have many purposes. As students collect their work, they can see their own growth and reflect on their learning. Portfolios can contain different types of materials, such as videotapes, audiocassette tapes, essays, short stories, poetry, research papers, and tests. In a brain-based classroom, students are encouraged to put some appropriate personal items in their portfolio. When I share my portfolio with audiences, I always pull out a picture of my best products: my children. Students often want to personalize their portfolios with pictures of pets or other items they care about. This brings an emotional "hook" to the process.

Rubrics, checklists, and personal notes can be used to assess the items in a portfolio. Occasionally, teachers give portfolio grades because they believe it will motivate students. Be careful with this because the grade may be seen as a reward or punishment and affect the student's self-confidence. If you must grade it, be sure that students have the criteria as they are assembling their portfolio, or perhaps suggest that students pick the item or items they want graded.

Grades/Report Cards. This form of assessment is what tends to put students in a stressful state or in a box. Instead of enjoying learning, the learning becomes "What must I do to get an 'A'?" Thomas Armstrong believes this is a way to keep students from becoming the geniuses that they are. Comparisons are made, and sometimes competition begins (Armstrong, 1998).

Because we probably aren't going to eradicate report cards, let's find the best possible way to live with them. If our other forms of assessment are ongoing and offer continual feedback, report card grades should be a consensus of those assessments. When the focus of the learning and the methods of assessment match, students will be able to see what they are accomplishing and what they have yet to do.

Conferences. These are usually parent-teacher conferences, and I always feel that the biggest mistake we make is not including the person who has the most at stake—the student! Instead of talking about them, we should be talking *with* them. Rick Stiggins's (2001) model of student-led conferences is one to be considered. This format gives students the responsibility for their achievement. There are numerous other benefits, such as improved student-teacher and student-parent relations.

Student-teacher conferences are very powerful ways of giving and receiving feedback. For the continuous feedback that is necessary for a brain-compatible classroom, the teacher cannot be the only source. It is important to use your teams and other configurations of students for this purpose;

however, it is also very important that teachers meet one-on-one with students for brief conferencing. Sometimes, just brief meetings can promote higher achievement.

Home Away From Home . . .

Research suggests that the more collaboration between teacher and student on the goals of learning and performance, the better the learning environment. Teachers who highlight the importance of using strategies for learning and memory as well as the importance of putting forth effort are helping students gain control over their learning (Holloway, 2000). The students are the most important component. We can spend a lot of time teaching, but if our students do not want to learn, they won't.

Research suggests that the more collaboration between teacher and student on the goals of learning and performance, the better the learning environment.

Creating an atmosphere that honors diversity, learning styles, multiple intelligences, memory pathways, cognitive development, and emotional needs sounds like a tall order. But I hope you can see from these chapters that it's possible. When we meet the needs of our students by giving them control and responsibility over their learning and by offering them novelty, predictability, choice, challenge, and feedback, we are giving them the opportunity to understand how they learn best.

The futurists predict that our students will be living up to 150 years. Considering all the breakthroughs in genetic research, I believe this is possible. My two children have careers that weren't available 10 years ago. We are preparing our students for a world we know nothing about. If we are truly effective educators, our students will leave us with the skills to remain lifelong learners.

We are working on infomercials for our state unit. The student teams are at various levels of accomplishing the task. One of the teams is

working on a computer presentation. Another is videotaping one of its segments. The social studies teacher and I work together to help the students learn to communicate information in a variety of ways.

As I dash from team to team handing out observation notes on their teamwork, I pass by Jay. Without looking up from the computer keyboard, he says, "Is this okay, Mom?" I turn. Jay realizes his error. His face is red, and the students are trying to control their laughter. He mumbles, "I didn't mean to say that. Come on, you guys!" To give him time to recover, I say, "Hasn't that ever happened to the rest of you? You get really comfortable somewhere and you're enjoying what you're doing—and you sort of forget where you are?" The kids nod and go back to their work. I go over to Jay to see what he wants. Because Jay has been one of my greatest challenges, I decide that I am flattered.

"How can I help you, Jay?"

"I can't even remember, but you know, I was having so much fun making this poster for our video, I thought I was home!"

Wizdom

- There are excellent resources on authentic assessment, such as *How to Assess Authentic Learning*, by Kay Burke (1999).
- Be cautious about giving students credit or extrinsic rewards for poor or inadequate work to raise self-esteem. There is a concept called *learned laziness* in which subjects are rewarded no matter what they do. As a result, they feel they have no control over their own actions (Sapolsky, 1998).
- Consider asking students to personalize their learning space to make your room more comfortable and more like "home."

Glossary of Terms

Acetylcholine: A neurotransmitter involved in learning and memory. It is present at higher levels during sleep.

ACTH: Adrenocorticotropin hormone is released during stress by the pituitary gland.

Adagio: A slow tempo or movement, as in a symphony.

Amygdala: Almond-shaped structure in the limbic area of the brain that catalogs emotional memory.

Authentic assessment: An assessment associated with a real-life task.

Automatic memory: This memory pathway is a conditioned response or reflexive memory.

Axon: The long nerve fiber on a neuron that sends messages to other neurons.

Brain stem: Also called the reptilian brain. This is the lower level of the brain where information enters.

Cerebellum: Also called the little brain. Located at the base of the brain, this structure is linked to posture, balance, coordination, and some memory.

Cerebrum: This structure consists of the right and left hemispheres. It has four lobes: frontal, parietal, occipital, and temporal.

Cingulate gyrus: This structure mediates information between the cortex and the limbic structures. It is located between them.

Corpus callosum: A bundle of nerve fibers connecting the left and right hemispheres.

Cortisol: The stress hormone secreted by the adrenal glands during stress.

CRF: Corticotropin releasing factor. This chemical is secreted by the hypothalamus. It causes the pituitary gland to release ACTH.

Dendrite: Thin fiber that grows from the cell body of the neuron. It receives information from other neurons.

Dopamine: A neurotransmitter involved in mood and movement.

Electroencephalogram: Usually referred to as EEG. It records your brain wave activity when you are concentrating, asleep, and awake.

Emotional memory: Memory dealing with feelings. It is cataloged through the amygdala.

Endorphin: A neurotransmitter, endogenous morphine, the body's natural painkiller.

Enkephalin: Involved in pain and pleasure, this peptide neurotransmitter is part of the endogenous morphine system.

Enteric nervous system: The local nervous system of the digestive tract.

Episodic memory: Memory involving location that is stored through the hippocampus.

Eustress: Mild, positive stress.

GABA: Gamma-aminobutyric acid, a neurotransmitter that prevents neurons from firing.

Glial cell: Brain cell that supports neurons.

Glutamate: Plentiful neurotransmitter involved with activating neurons.

Hippocampus: Seahorse-shaped structure involved with factual memory.

Homeostasis: The literal meaning is "keeping things the same." The body/brain seeks to keep balance.

HPA axis: The HPA (hypothalamus-pituitary-adrenal) axis is the system that responds to stress. Its final products, corticosteroids, target components of the limbic system, particularly the hippocampus.

Hypothalamus: Located beneath the thalamus, this structure regulates internal information.

Interneuron: A nerve cell found entirely within the nervous system that acts as a link between sensory and motor neurons.

Limbic brain: A group of structures in the brain associated with memory and emotions.

Locus coeruleus: A brain stem structure that has projections to brain structures involved in learning and memory, including the temporal lobe, hippocampus, hypothalamus, amygdala, nucleus accumbens, and prefrontal cortex.

Mammillary bodies: Memory processing structures connected to the hippocampus.

MRI: Magnetic resonance imaging, a technique that uses a magnetic field to map brain structure.

Myelin: White fatty substance that coats the axons of most neurons. It speeds transmission of messages.

Neocortex: The top layer of the cerebrum, in which higher-level thinking occurs.

Neural network: A connection among neurons that forms a pattern.

Neuron: The nerve cell of the brain involved in learning.

Neurotransmitters: Chemicals produced in neurons to send messages.

Norepinephrine: A neurotransmitter involved in our state of arousal.

Parasympathetic nervous system: This system is concerned with conservation and restoration of energy. It causes a reduction in heart rate and blood pressure and facilitates digestion, absorption of nutrients, and excretion of waste products.

Performance assessment: The demonstration of a skill or behavior using a rubric.

PET scan: Positron emission tomography, a brain-imaging technique that uses radioactive glucose to measure the amount of glucose used by various areas of the brain during specific tasks.

Pineal gland: This gland regulates the release of neurotransmitters in charge of sleep.

Pituitary gland: The gland that runs the endocrine system. It is involved in the stress response.

Plasticity: The brain's ability to change.

Portfolio: A collection of student work showing progress over time. It may be used for assessment and/or reflection.

Reptilian brain: Another term for brain stem, the most primitive area of the brain.

Rubric: An assessment instrument using specific criteria to create and assess a performance or product.

Semantic memory: Factual memory associated with the hippocampus.

Serotonin: A neurotransmitter involved in regulating mood.

Sympathetic nervous system: This system enables the body to be prepared for fear, flight, or fight.

Synapse: The space between the axon of the sending neuron and the dendrite of the receiving neuron.

Thalamus: This structure in the limbic area of the brain sorts messages.

Triune brain theory: The three-system theory of the brain developed by Dr. Paul Maclean.

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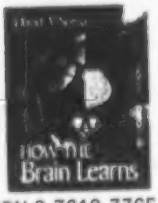

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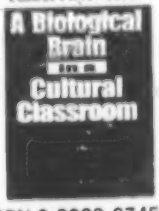

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